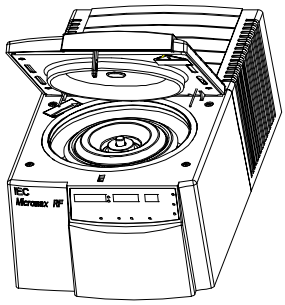
SERVICE MANUAL
SM3590

Revision 2



Micromax

Ventilated Microcentrifuge
Cat. No. 3590 -- For 120 VAC, 60 Hz
Cat. No. 3591 -- For 220 - 240 VAC, 50/60 Hz
Cat. No. 3595 -- For 100 VAC, 50/60 Hz

Refrigerated Microcentrifuge
Cat. No. 3592 -- For 120 VAC, 60 Hz
Cat. No. 3593 -- For 220 - 240 VAC, 50 Hz
Cat. No. 3594 -- For 220 - 230 VAC, 60 Hz
Cat. No. 3596 -- For 100 VAC, 50/60 Hz

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1 INTRODUCTION

The Micromax microcentrifuge is a quiet, high-speed bench-top centrifuge for medical, industrial, and scientific laboratories. The unit can achieve centrifugal force of up to 21,000 xg, making it ideal for sedimentation of protein precipitates and separation of blood serum.

NOTE: The Micromax microcentrifuge is available in two versions, ventilated and refrigerated. The parts of this manual that apply to the refrigerated version will be identified as RF only.

The unit reaches full speed within 15 seconds, even when fully loaded, and brakes to a stop in approximately 15 seconds. It features a maintenance-free, brushless motor and an easy-to-use front panel which provides three versatile modes of operation: automatic timed run, momentary spin (pulse) and continuous operation (hold mode). Acceleration and deceleration rates may be controlled to optimize runs - rapid for fast separations or slow for delicate samples. Repeat runs with precisely the same speed and time settings may be achieved at the touch of a button.

Micromax is a variable-speed unit with a range of 1000 to 15,000 RPM. The unit accommodates lightweight, dynamically-balanced polypropylene rotors. The rotors cannot corrode, offer excellent acceleration and deceleration characteristics and totally contain tubes, allowing complete sample recovery even if a tube breaks.

The 891 rotor holds up to 24 sample tubes and provides aerosol containment for biological samples. The 851 rotor holds up to 24 x 1.5-2 mL and 24 x 0.5 mL sample tubes, the 852 rotor holds up to 48 x 0.5 mL or 24 x Microtainer tubes and the 853 rotor holds up to 40 x 0.25 mL/0.4 mL or 6 x 50 mm glass tubes. Also, the 851 rotor has room to accommodate screw-cap microtubes, microtube filters, and micro spin-columns. Section 4.1 provides a speed and force table for these rotors.

A fail-safe cover interlock ensures that the cover is closed before a run can begin and keeps the cover closed until the rotor has reached a safe low speed (below 150 rpm), even in the event of a power failure.

2 INSTALLATION

2.1 Receiving the Unit

IEC ships the centrifuge in a carton that protects it from shipping hazards. Retain the carton and packing material through the warranty period in case you need to ship or return the unit. Please be sure to complete the Warranty Registration Card and return it to IEC.

2.2 Site Preparation

The unit normally resides on a bench-top. The Micromax (ventilated model) can be placed in a cold room (no colder than 0°C) for processing temperature-sensitive samples. When you remove the centrifuge from a cold environment, allow at least two hours for any condensate to evaporate before using.

Note: When used in a cold room environment, some bearing noise may become evident. The bearing lubricant thickens at low temperatures. As the centrifuge speeds up, it is thinned and distributed more evenly. Once this occurs, any noise should subside.

The Specifications at the end of this manual give the dimensions of the unit. Provide clearance of 8 cm (3 inches) at the rear and on both sides for heat dissipation. Provide clearance of 28 cm (11 inches) above the unit to open the cover.

Place the unit on a clean, dry surface to ensure that the suction feet grip the surface firmly. Be sure that the area beneath the unit is clear of debris and loose materials such as paper. The surface must be level to ensure quiet, vibration-free operation. A stable location is important since an improperly-loaded unit can vibrate and the centrifuge must not be permitted to move during operation.

2.3 Power Configuration

The Micromax model numbers, and voltage and frequency requirements are listed in the table below.

MODEL	VOLTAGE	FREQUENCY
3590	120	60 Hz
3591	220 - 240	50/60 Hz
3592 (RF)	120	60 Hz
3593 (RF)	220 - 240	50 Hz
3594 (RF)	220,230	60 Hz
3595	100	50/60
3596 (RF)	100	50/60 Hz*

Ensure that your site is configured to match the centrifuge's power requirements. **Plugging the Micromax into incorrect voltage or frequency will void your warranty.**

*** Line Frequency Selection (3596, Micromax RF)**

Locate the 50/60 Hz selector switch to the left of the power receptacle at the rear of the centrifuge. Adjust this switch to match the line frequency at the site.

Fuses

Fuses are located at the back of the unit.

To install fuses:

Locate the power entry module on the back side of the unit. The removable fuse drawer is located in the module. A small latch holds the drawer in place. Press this latch, then slide the drawer out.

- Cat. No. 3590: The fuse drawer will have one spare and one active fuse installed at the factory. Fuse is rated for 6.25 Amps (part no. 50606B).
- Cat. No. 3591: The fuse drawer will have two active fuses installed at the factory. Fuse is rated for 4.0 Amps (part no. 43689).
- Cat. No. 3592: The fuse drawer will have one spare and one active fuse installed at the factory. Fuse is rated for 8 Amps (part no. 50606A).

- Cat. No. 3593, 3594: The fuse drawer will have two active fuses installed at the factory. Fuse is rated for 6.3 Amps (part no. 50607A).

- Cat No. 3595: The fuse drawer will have one spare and one active fuse installed at the factory. Fuse is rated for 8.0 Amps (part no. 50021).

- Cat No. 3596: The fuse drawer will have one spare and one active fuse installed at the factory. Fuse is rated for 10.0 Amps (part no. 49998). Note that the frequency selector adjacent to the power entry module must be set for the correct frequency.

Ensure that the fuses are securely in place and reinstall the entire drawer into the power entry module.

Power Cord

IEC provides a power cord with each Micromax centrifuge. The unit requires a grounded power supply (3-prong power outlet). If your facility does not have properly grounded power outlets, arrange for proper grounding. Do not remove the grounding pin from the centrifuge power cord. Do not use an adapter to connect to a 2-prong outlet.

2.4 Moving the Unit

Suction cups located on the base of the unit are a safety feature which adhere it to the work surface to prevent it from moving. To move the unit to another location, insert an object such as a tongue depressor under each suction cup to break the vacuum seal of that cup (taking care not to damage the suction cup surface). When all four cups are disabled, you can easily lift the unit. When the unit is in its new location, ensure that the suction cups fully contact the benchtop again.

2.5 Front Panel

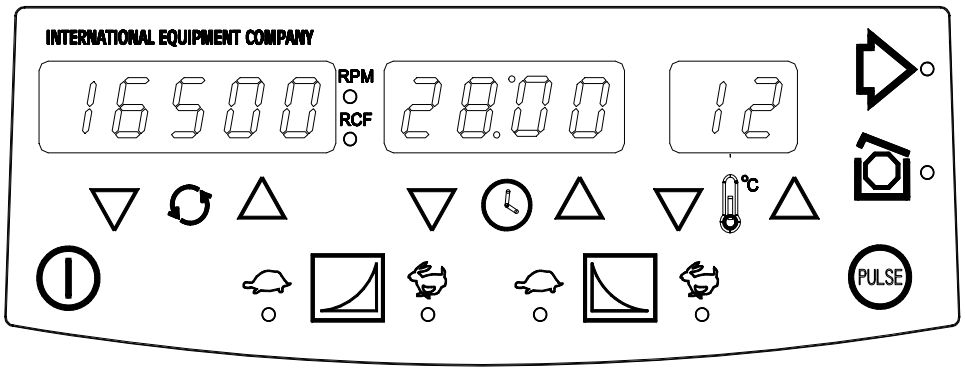


Figure 1: The Front Control Panel

The On/Off button must be on to use the unit. This button applies power to the control panel and refrigeration system (RF only). The red STOP light indicates that the centrifuge is plugged in. (In RF models, temperature is displayed whenever the unit is plugged in.) The On/Off button is inoperative during the actual run. Shut off refrigeration with the On/Off button, but stop a run with the STOP button.

The control panel contains numeric displays for RPM/RCF (SPEED/FORCE), TIME and TEMPERATURE (RF only). These displays have two states or modes: Actual and Set. In the Actual mode, they indicate current run conditions such as:

- rotor speed or force
- elapsed time of, or time remaining in, the run
- actual temperature (RF only).

The display in the Set mode indicates the desired settings for the run and is operative:

- whenever you use the up and down arrows
- briefly at the start of a run
- briefly after the unit is switched ON

When the display shows Actual parameters, the numbers are bright; when the display shows Set parameters, the numbers are dim. The numeric displays can also display warning or error messages (see Section 3.3). Descriptions of the displays appear below.

The displays for the Micromax are:

Speed/Force display: The number in the display above this symbol represents the rotor speed in RPM or force in RCF. When RPM is selected the display indicates revolutions per minute. When RCF is selected the display indicates relative centrifugal force. Press this button to toggle between RPM and RCF. Use the arrow buttons to change the set speed or force. The display shows speed within 100 RPM and never requires calibration. Select speed in increments of 100 RPM from 1000 through 15,000 RPM. Select RCF in increments from 1 - 1000 xg by 50 xg, from 1,000 - 10,000 xg by 100 xg, and from 10,000 - 21,000 by 200 xg.

Time display: The number in the display above this symbol indicates time. Time is displayed as minutes:seconds. You can set time from 1 second to 99 minutes using the arrow buttons. In normal timed mode, the system counts down from set point. In continuous or momentary spin modes, the system counts up.

Temperature display: The number above this symbol represents temperature in whole degrees Celsius from -9 °C through 40 °C (RF only).

Use the arrow buttons to view or change the Set parameters for Speed/Force, Time or Temperature (RF only). The first time the button is pressed, the numeric display simply switches from Actual readings to Set parameters, without changing them. If you press the button again, the selected parameter increases or decreases once for each press. If you hold the button down, the setting changes repeatedly until you release the button.

The longer you hold the button down, the more rapidly the setting changes. Usually, you hold a button down to approach a desired setting, then press the up or down button repeatedly to select the exact setting. When you release the arrow buttons for 3 seconds, the display returns to the Actual readings.

Acceleration/Deceleration: The user has the option of setting either full (rapid) or gentle acceleration and braking. The gentle option may be used to avoid mixing of density gradients or breakup of pellets. A description of the two options follows:

This button is used to increase rotor acceleration (up to 1500 RPM) or rotor deceleration. If the yellow light over the rabbit is lit, then full acceleration/deceleration is selected.

This button is used to decrease rotor acceleration or deceleration. If the yellow light over the turtle is lit, then slow acceleration/deceleration is selected. Slow acceleration takes from 5 to 10 seconds to achieve 1500 RPM, depending on the rotor and its contents. In slow braking, the rotor will coast down from 1500 RPM. If no light is lit, the rotor coasts naturally to a stop.

When using the 851, 852 , 853 or 891 rotors the difference in time between full and slow braking is approximately a half second.

This button starts a run. The run is governed by the Set parameters. The associated green light blinks until the rotor reaches the set run speed. Then the light stays on until the end of the run. On some ventilated units only, the cover opens at the end of a run.

This button stops the run, and unlocks the cover when the rotor has slowed to below 150 rpm. (A run will also stop automatically when the set time has elapsed or the momentary run button is released.) The red light will flash as an indication that the rotor is still slowing down (braking). When the run ends, the red light stays on, indicating that the rotor has stopped and the cover can be opened.

The centrifuge will run up to set speed while this button is pressed, and stop when it is released.

2.6 Refrigeration (RF only)

Models 3592, 3593, 3594 and 3596 are refrigerated models. Whenever the cover of one of these units is closed and the unit is switched ON, the refrigeration system begins to cool the rotor chamber to the set temperature.

Note: The unit is not designed for use as a refrigerator. The natural fanning action of rotor serves to maintain a uniform temperature distribution inside the chamber. Therefore, at zero RPM, there is no correlation between set and actual chamber temperatures.

If a run begins and the rotor chamber is not at the specified temperature, the run will not be aborted. If desired, press STOP to discontinue the run and pre-cool the chamber by spinning the rotor (empty) until you are satisfied with the temperature.

If a temperature higher than ambient is specified, the units will not heat the rotor chamber except through the normal heating effect of the equipment (friction and motor heat).

Remove frost or condensation from the rotor chamber by first allowing it to melt and then removing it with a sponge or cloth. When a centrifuge is not in use, turn it off or leave the cover open (disables refrigeration).

2.7 First Run

Plug in the centrifuge. If an arrow key is pressed first, the display will briefly show 10,000 RPM, 1:00 minute and 25 °C (RF only) the default set values. Press the Stop/Open Cover button to release the cover interlock. Open the cover. Remove any loose material from the rotor chamber. Install a rotor, as described in Section 3.1. Close the cover and press it down until it latches.

Use the up or down arrow buttons to select Set parameters. Experiment with the buttons to see how they control the displayed settings. Press and hold a button to scroll quickly. This does not activate the rotor. Note that, when you release all buttons for over 3 seconds, the display returns to Actual readings.

Select an appropriate time, speed and temperature (RF only) and then press the START button. The rotor will accelerate to set speed, spin for the set time, and brake to a stop. Press the Stop/Open Cover button to release the safety interlock.

3 OPERATION

3.1 Rotor and Accessories

A balanced load is essential with all high-speed centrifuges. An unbalanced load produces vibration and causes excessive wear of motor bearings. Therefore, always load the rotor symmetrically. When using tube adapters, install an adapter in the opposite tube position. The total weight of samples loaded in opposing positions must be equal in weight to within 1.0 gram. The position numbers, present on rotors, identify opposing tube positions.

Samples of different specific gravities can be processed in the same run, provided that the samples of a given type are balanced around the rotor as though they were the only ones in the rotor.

Rotor Installation

To install the rotor, lower it straight onto the shaft. Align the holes in the rotor with the positioning pins on the shaft. To do this, hold the rotor in one hand and hold the shaft, as it protrudes through the rotor, with the other hand. Rotate them in opposite directions until the pins line up with the holes and the rotor drops down into position. Do not apply excessive force. Screw the metal locking nut (clockwise) on the shaft to hold the rotor down. Be sure the orange rubber ring is facing downward. Hold the rotor and tighten the nut moderately with your fingers; do not over tighten it.

The 891 rotor cover must be installed prior to the rotor being placed in the centrifuge. Verify that the o-ring seals (2) are in place around the outer and inner perimeters of the rotor. To install the cover, place the rotor on a flat surface and then place the rotor cover on top of the rotor. Using the palm of your hand(s), press down evenly around the cover to fully engage the seals.

The 851, 852 and 853 rotor covers prevent generation of aerodynamic noise during the spin. It also prevents gross aerosol effects in the event of tube failure. It fits snugly over the rotor and pulls off easily. To place it properly, rotate the cover until it drops easily onto the adapter spline. Press down until the rim of the cover contacts the rotor. The spline at the top of the shaft adapter drives the lid during rotation.

Caution: Improper placement of the cover may allow it to come off during a spin.

Rotor Removal To remove the rotor, first remove the cover (851, 852 or 853 only). Then unscrew (counterclockwise) and remove the metal locking nut. The rotor can now be lifted straight out of the rotor chamber. You can refrigerate the rotor without removing the tubes but do not operate the rotor when the rotor temperature is below 0°C.

To remove the 891 rotor cover, place the rotor on a flat surface. Place your thumbs on the inner perimeter of the cover, and your fingers on the outer edge. Pry it up from the outer edges.

3.2 Operating Modes

The Micromax Models offer three operating modes: Timed, Continuous (Hold), and Momentary.

Timed Run To start a timed run or spin:

Select the Set parameters using the control panel buttons (refer to Section 2.5) and then press START.

- **To view the set parameters at any time, press any arrow key.**

- The spin duration may be changed at any time, even during the spin, by pressing the arrow keys until the new desired setting(s) is displayed. If a time less than the elapsed time is programmed (for example, one second), the spin ends immediately. If a time greater than the elapsed time is programmed, the elapsed time continues until the newly selected time is reached (the time does not reset).

The speed and temperature (RF only) may similarly be changed during a run. Three seconds after the parameter's arrow key is released, the centrifuge will adjust to the newly set parameter.

Hold Mode To set Hold (continuous) mode:

Select the Set parameters using the control panel buttons (refer to Section 2.5). Scroll down through zero time on the Time display until the word Hold appears in the display.

This mode is used for runs greater than 99 minutes.

Momentary To operate in the momentary mode:

Select the Set parameters using the control panel buttons (refer to Section 2.5). Press and hold the PULSE button. The run begins when you press the button and ends when you release the button.

NOTE: In this mode the unit displays Set parameters for three seconds, the time display counts upward and displays the elapsed time since you pressed the PULSE button.

In this mode very quick separations can be performed, or you may closely monitor the progress of a run. (This is useful for easily separated samples, for simultaneous mixing of samples, and to deposit condensate droplets at the bottom of the tube.)

3.3 Warning Messages and Error Codes

The beeper sounds in three situations:

- Two times on power up.
- Three times at the end of a spin.
- When a warning occurs (three times).

Warnings appear in place of the numeric displays in the following cases:

HEAD This appears if a run is started without loading a rotor into the chamber. Opening the cover resets this warning. This warning is disabled when slow acceleration is selected.

LId This appears briefly if you press the START button but the cover is not closed. Closing the cover resets the warning.

PFAIL This appears at the end of a power failure that interrupts a run if the rotor is still spinning when power is restored. Press STOP to reset this warning.

Error Codes require factory-authorized maintenance. A typical error means the internal microprocessor has detected impermissible readings or a failure elsewhere in the unit. An error code number appears on the front panel. When an error code is displayed first unplug and reconnect the unit to power and try the run again. If the error code reappears, tell the service personnel which number appeared when you report the problem.

Err 1 **No Tachometer**
Tachometer signals were not present during run. The rotor coasts to a stop. Cover opening is inhibited after this error.

OSPd **Overspeed**
Speed is 15,200 RPM. The rotor will brake to a stop

run A **Runaway**
During stopping, rotor has not been decelerating for 8 seconds, or when at standby, rotor speed exceeds 600 RPM. The rotor coasts to a stop.

rEFr **Refrigeration Failure (RF only)**
The unit displays this code if the measured temperature exceeds 45 °C at any time during the run.

FSAFE **Fail-safe Time-out**
Independent circuitry on the circuit board has sensed a lack of activity from the control microprocessor. All power outputs are disabled (including motor, latch solenoid, etc.).

COPF **COP Watchdog/OpCode Trap Error**
The microprocessor itself has sensed a lack of activity from the program that controls the centrifuge. The rotor coasts to a stop.

COP **COP Watchdog Not Enabled**
The microprocessor COP is not enabled. The rotor coasts to a stop.

UndFl **Undefined Interrupt**
The microprocessor was interrupted by an undefined source. The rotor coasts to a stop.

lLLOP **Op-Code Trap Error**
The rotor coasts to a stop.

Warnings during a spin. The "HEAd", "Lld", "PFAIL" and "Error" messages can occur during a spin. In this case, the rotor brakes or coasts to a stop and the run ends.

4 APPLICATIONS

Misapplication of any tube can cause tube rupture. To avoid this, never spin tubes faster than their recommended G-force, and never centrifuge disposable tubes more than once. If the tubes are not rated for the needed force, use more suitable tubes. If breakage does occur, residue will be captive in the tube cavity in the rotor. You may be able to recover it by pipetting.

Corrosive solvents Your IEC centrifuge is made of materials designed to resist attack from common laboratory chemicals. The rotor and lid are made of polypropylene and the interior of the rotor chamber is stainless steel. Use covered sample tubes if the samples contain acids or solvents known to attack these materials. Promptly cleaning spills from the rotor and from the sample chamber minimizes the effects of corrosive chemicals. Replace any component that exhibits crazing, frosting, peeling, or similar faults. Do so before any resulting vibration requires more expensive repair. Replace the shaft adapter, rotor, lid, or metal locking nut if they become cracked, scratched, or gouged.

Sample Heating The rotor chambers of Models 3590 and 3591 centrifuges are ventilated during operation. However, during very long runs, some heat inevitably travels to the samples. You can minimize sample heating by placing the unit in a refrigerator or cold room.

4.1 Speed and Force Table

Rotor Cat. No.	No. of Tubes and Tube Size	Adapter Cat. No	Max Speed (RPM)	Max RCF (xg)	Radius (cm)
891[1] (Aerosol Contained)	24 x 1.5ml	-	15000	21004	8.35
	24 x 0.6ml B/D Microtainers™	5763**		21256	8.45
	24 x 0.5ml PCR microtubes	5763**		18740	7.45
	24 x 0.4ml microtubes	5764**		21004	8.35
	24 x 0.25ml microtubes	5764**		18237	7.25
851[2]	24 x 1.5ml	-	15000	21004	8.35
	24 x 0.6ml B/D Microtainers™	5763**		21256	8.45
	24 x 0.5 ml microtubes	-		17432	6.93
	24 x 0.5ml PCR microtubes	5763**		18740	7.45
	24 x 0.4ml microtubes	5764**		21004	8.35
	24 x 0.25ml microtubes	5764**		18237	7.25
852[2]	48 x 0.5ml PCR microtubes	-	15000	20124	8.00†
				18866	7.50‡
	24 x B/D Microtainers™	-		21633	8.60†
853[2]	40 x 0.4ml microtubes	-	15000	21130	8.40
	40 x 0.25ml microtubes	-		18866	7.50
	40 x 0.8ml (6x50mm) glass	-		21382	8.50

Microtainers™ is a trademark of Becton Dickinson

* RCF displayed on control panel is based upon radius of rotation for 891 and 851 rotors for 1.5/2.0ml tubes (8.35cm).

** Order 2 pks of adapters separately. IEC 5763 and 5764 are packaged 12/pk.

† Outer row holds 24 tubes

‡ Inner row holds 24 tubes

1 IEC 891 Rotor

Provides Aerosol Containment and has been tested for microbiological containment by PHLS-CAMR, Porton Down. Meets requirements of US OSHA Bloodborne Pathogen Final Rule: (Regulation 29 CFR Part 1910.1030. Complete with IEC 50417 Aerosol Containment Cover, IEC 50525 Inner and IEC 36597 Outer rubber O-ring seals.

2 IEC 851, 852, 853 rotors

4.2 Chemical Resistance Table

	Plastic										Metal					Other			
	PA	**PC**	**PE**	**PP**	**PU**	**NL**	**DN**	**CN**	**NN**	**PS**	**TI**	**SS**	**AL**	**MB**	**MG**	**RR**	**BN**	**VN**	**PF**
Acids, dilute or weak	E	E	E	E	G	E	F	N	F	E	G	G	F	F	N	F	E	E	E
Acids*, strong or conc.	E	N	E	E	F	N	N	N	N	F	N	N	N	N	N	N	F	G	N
Alcohols, aliphatic	E	G	E	E	F	E	E	E	N	E	E	E	E	E	F	E	E	G	E
Aldehydes	G	F	G	G	G	G	G	G	F	N	E	E	E	E	E	E	N	E	E
Bases	E	N	E	E	N	G	N	G	F	E	E	E	E	E	E	G	G	N	N
Esters	G	N	G	G	N	E	G	G	E	N	E	E	E	E	E	N	N	N	E
Hydrocarbons, aliphatic	G	F	G	G	E	N	E	E	E	N	E	E	E	E	E	N	E	E	E
Hydrocarbons, aromatic	F	N	G	F	N	N	E	E	E	N	E	E	E	E	E	N	N	E	E
Hydrocarbons, halogenated	F	N	F	F	N	N	G	E	G	N	E	E	E	E	N	N	N	F	E
Ketones	G	N	G	G	N	N	E	E	E	N	E	G	G	G	E	N	N	N	E
Oxidizing Agents, strong	F	N	F	F	N	N	N	N	N	N	E	F	N	N	N	N	F	E	E
Salts	E	E	E	E	E	E	E	E	E	E	E	F	F	F	N	E	E	E	E

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER
PC - POLYCARBONATE
PE - POLYETHYLENE
PP - POLYPROPYLENE
PU - POLYURETHANE
NL - MODIFIED PHENYLENE OXIDE (NORYL)
DN - ACETAL HOMOPOLYMER (DELRIN)
CN - ACETAL COPOLYMER (CELCON)
NN - NYLON
PS - POLYSTYRENE

TI - TITANIUM
SS - STAINLESS STEEL
AL - ALUMINUM
MB - MANGANESE BRONZE
MG - MAGNESIUM
RR - RUBBER
BN - BUNA-N
VN - VITON
PF - PHENOLIC FIBER

Classification of Resistance

E= Excellent
G= Good
F= Fair
N= Not Recommended

4.3 Decontamination Table

Compatible Processes For Decontamination																				
Sterilization Methods	**Plastic**										**Metal**					**Other**				
	PA	**PC**	**PE**	**PP**	**PU**	**NL**	**DN**	**CN**	**NN**	**PS**	**TI**	**SS**	**AL**	**MB**	**MG**	**RR**	**BN**	**VN**	**PF**	**PT**
Mechanical																				
Autoclave*	S	M	U	S	M	U	S	S	S	U	S	S	S	S	S	S	S	M	S	M
Ethylene Oxide Gas	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	U	U	S	S	S
Dry Heat 160°C@2Hrs.	U	U	U	U	U	U	U	U	U	U	S	S	U	S	S	U	U	U	U	U
Chemical																				
Ethanol	S	S	S	S	U	S	S	S	U	M	S	S	S	S	S	S	S	S	S	S
40% Formalin	S	S	S	S	U	S	S	S	S	U	S	S	S	S	S	S	U	S	S	S
Methanol	S	M	S	S	M	S	S	S	U	M	S	S	S	S	S	S	S	U	S	S
2-Propanol	S	S	S	S	M	S	S	S	U	S	S	S	S	S	M	S	S	S	S	S
5% Sodium Hypochlorite**	S	S	S	S	U	S	U	U	U	S	S	M	U	U	U	S	U	S	S	M
3% Hydrogen Peroxide	S	S	S	S	S	S	M	S	U	S	S	S	S	S	U	S	S	S	S	M
100% Hydrogen Peroxide	S	S	S	S	S	U	U	U	U	S	S	S	S	S	S	U	U	S	S	U
5% Phenol Solution	M	U	U	S	U	U	M	M	U	M	M	M	M	M	M	M	U	S	S	U

PA - POLYALLOMER
PC - POLYCARBONATE
PE - POLYETHYLENE
PP - POLYPROPYLENE
PU - POLYURETHANE
NL - MODIFIED PHENYLENE OXIDE (NORYL)
DN - ACETAL HOMOPOLYMER (DELRIN)
CN - ACETAL COPOLYMER (CELCON)
NN - NYLON
PS - POLYSTYRENE

TI - TITANIUM
SS - STAINLESS STEEL
AL - ALUMINUM
MB - MANGANESE BRONZE
MG - MAGNESIUM
RR - RUBBER
BN - BUNA-N
VN - VITON
PF - PHENOLIC FIBER
PT - PAINTED SURFACES

*Autoclaving
121°C 20 min.@
2 ATM (15 PSIG)

**Household Bleach

S=SATISFACTORY
M=MARGINAL
U=UNSATISFACTORY

WARNING:

This chart describes the material compatibility of various sterilization methods. It does not specify the adequacy of sterilization. Refer to section 4.3 Chemical Resistance Table for material compatibility during centrifugation.

5 MAINTENANCE

The Micromax centrifuge is maintenance-free. In particular, the drive motor is permanently lubricated and has no brushes to replace.

5.1 Cleaning

Keep your centrifuge clean to ensure good operation and to extend its life. Clean the entire sample chamber, rotor, and lid at the end of each 8-hour shift and right after any spill.

To clean the rotor chamber, cabinet and suction feet, use a damp sponge, warm water, and a mild liquid soap. Do not use acetone. Remove stubborn stains with a plastic scrub pad, not steel wool. Never pour water directly into the sample chamber. Scrub the rotor's tube cavities with a stiff test-tube brush that has end bristles and a non-metallic tip. After cleaning any part, dry it properly, preferably using a clean, absorbent towel.

Decontamination

Decontamination is called for if tube breakage occurs and infectious, pathogenic, or radioactive material is released into the unit. If spillage is confined to the polypropylene rotor, it may be sufficient to decontaminate the rotor, which is totally compatible with household bleach at a one-to-ten dilution and radioactivity decontamination washes such as Count-Off.

Sterilization can be done by autoclaving. Remove sample tubes before autoclaving, unless they are completely full of sample; or remove caps, stoppers, and other tube closures, before autoclaving to keep tubes from collapsing under pressure. Autoclave the polypropylene rotor and accessories at 121° C @ 15 psig for 20 minutes. Do not stack rotors during autoclaving. After the rotor cools to the touch, do a normal cleaning as described above.

5.2 Cover Interlock Bypass

If power fails, the cover remains locked. If you need to remove samples from the unit before power is restored, use the cover interlock bypass.

DO NOT ATTEMPT MECHANICAL BYPASS IF ROTOR IS ROTATING

Bypass procedure:

1. **Unplug the centrifuge from electrical power. Do not perform cover interlock bypass unless instrument is removed from live electrical outlet.**
2. At the right front bottom of the centrifuge, remove the small plastic plug.
3. Reach under and pull on the string that is attached to the plug. The latch will open.
4. Replace the plug at the front, right, bottom of the centrifuge.
5. Return the centrifuge to operation.

5.3 Troubleshooting

If the unit fails, follow this procedure:

No motor operation, and no Display lights are lit. Verify that the unit is plugged into a live electric outlet. Check the circuit at the fuse or circuit breaker, or plug a lamp or other appliance into the outlet to verify it.

If there is power, examine the centrifuge's fuse. Unplug the unit and locate the fuse drawer at the rear of the unit. Remove the fuse drawer according to section 2.3. Examine the fuse. If it is blown, or if you are in doubt, replace it with one of the spare fuses from the plastic bag shipped with the unit (see section 2.3). Plug the centrifuge back in and see if it works. If replacing the fuse did not solve the problem, call IEC for assistance.

No motor operation, but the displays are lit. Check that the cover is properly closed. Press the START button. If you do not hear rotation, call IEC for assistance.

On any other failure or erratic operation, contact IEC or your IEC Distributor for assistance.

5.4 Table of Spare Parts

Cat No.	Description
49856	Rotor Cover (851, 852, 853)
50417	Rotor Cover (891)
65690	Rotor Nut (851, 852, 853)
50469	Rotor Nut (891)
65231	Rotor nut washer
43689*	4 Amp fuse
50606B*	6.25 Amp fuse
50607A*	6.3 Amp fuse
50606A*	8 Amp fuse
50021*	8 Amp fuse
49998*	10 Amp fuse
50524	O-ring (891 rotor - Inner)
36597	O-ring (891 rotor - Outer)
2084	Grease Tube (for O-rings)

* see section 2.3 for fuse selection

5.5 Fuses Not Replaceable By Operator

F1	6.3A	Fast	250V
F2	0.75A	Fast	125V
F3	0.75A	Fast	125V

5.6 Warranty

IEC wants you to be satisfied with the quality of your Micromax centrifuge. We warrantee your IEC centrifuge for one year and IEC rotors for seven years. We will repair or replace any of these products that fails, within this period from the date of its delivery, due to defects in material and workmanship, and we will ship you the repaired product or its replacement at our expense. You must use IEC-approved accessories and genuine IEC spare parts. This warranty does not apply to any instrument that has been repaired without authorization or abused.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE, AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BYLAW. THE FOREGOING STATES OUR ENTIRE AND EXCLUSIVE LIABILITY, AND BUYER'S EXCLUSIVE REMEDY, FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION, OR OPERATION. IEC WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE PURCHASE PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED. IN SOME INSTANCES, UNITS MAY CONTAIN RECONDITIONED (AS NEW) PARTS.

5.7 Condition of Returned Equipment

Before returning equipment to IEC, you must contact IEC's or your dealer’s service department and receive a return goods authorization (RGA). All returned units must be decontaminated, free of radioactivity, and free of hazardous and infectious materials. The RGA paperwork includes a certificate for you to sign indicating that you have performed these steps. IEC will not accept the shipment unless this signed certificate accompanies it. You must prepay transportation to the service depot.

6 SPECIFICATIONS

MODEL	VOLTAGE	FREQUENCY
3590	120	60 Hz
3591	220 - 240	50/60 Hz
3592 (RF)	120	60 Hz
3593 (RF)	220 - 240	50 Hz
3594 (RF)	220, 230	60 Hz
3595	100	50/60 Hz
3596 (RF)	100	50/60 Hz

Maximum Speed	15,000 RPM
Maximum Force	21,000 xg
Maximum Number of Tubes	24 x 24 (1.5 x 0.5 mL) (851 rotor), and 48 x 0.5 mL (852 rotor)
Maximum Sample Volume	60 mL (851 rotor 24 x 2.0 mL and 24 x 0.5 mL)
Operator Controls	
Rotation	1,000 -1,5000 by 100 RPM
Spin Duration	0:01 through 0:59, by 1 sec. 1:00 through 4:45, by 15 sec. 5:00 through 99, by 1 min.
	Momentary Spin mode Continuous (Hold) mode
Repeatability	
Rotation	Within 10 RPM
Spin Timing	0.1 sec.
Temperature (RF only)	+/- 1 °C in the range +4 °C to ambient
Motor	Brushless DC motor (maintenance free)

Refrigeration system (RF only)	Hermetic compressor 1/4 hp
Refrigerant (RF only)	R-404A (HP-62)
Dimensions	
Height	24.9 cm (9.8 in) cover closed 50.3 cm (19.8 in) cover open
Width	30.5 cm (12 in)
Depth	33.8 cm (13.3 in)
Weight 120 VAC	16.4 kg (36 lb.)
Weight 240 VAC	19.3 kg (42.5 lb.)
Dimensions (RF only)	
Height	24.9 cm (9.8 in) cover closed 50.3 cm (19.8 in) cover open
Width	30.5 cm (12 in)
Depth	58.9 cm (23.2 in)
Weight 120 VAC	32 kg (70.5 lb.)
Weight 240 VAC	35 kg (77 lb.)

7 SERVICE

7.1 Warnings and Cautions

Warnings

Many service procedures require operation with the cabinet removed. The On/Off key, on the control panel, activates the display and the refrigeration system (RF models only) but **does not** remove power from the circuit board or other internal components.

There is no power switch that provides a safe alternative to unplugging the unit.

Do not touch internal electrical components when the power cord is plugged in.

The power cord(s) provided with these units is rated for the centrifuge's highest current demand. Exchange of power cords between equipment may create a fire hazard.

Do not exchange the supplied power cord with cords from other equipment.

The refrigerated Micromax models use pressurized refrigerant gases that are potential asphyxiants. All maintenance on the refrigeration unit should be performed in a well-ventilated area.

Any charging or discharging of refrigerant must be performed by certified refrigeration service personnel, using proper charging and recovery systems.

Cautions

The circuit boards contain electronic devices that can be damaged by static electricity. Service personnel should be properly grounded (such as by wearing a wrist strap) whenever handling or touching the circuit boards or individual components. When transporting a circuit board, always enclose it in a static-protective bag.

7.2 Special Tools

No special tools are required. A multimeter is required to perform diagnostics.

7.3 Troubleshooting

The Micromax has been designed to sense most malfunctions, and to indicate the nature of a problem with a diagnostic message, displayed on the control panel. Diagnostic messages can be divided into two types: *warning messages* and *error codes*. These are explained in the following tables. Warning messages indicate an improper operation condition, and can normally be resolved by correcting the condition and resetting the unit. Error codes may indicate a serious malfunction. In some cases they will be cleared by unplugging the unit and plugging it back in. If the error code repeats, the troubleshooting steps in the tables below are recommended. If this does not resolve the problem, please contact IEC's Technical Service dept. at +(871) 449-8060.

WARNING: The following procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

Lid	Indicates the cover was not fully closed when the START button was pressed. Message is cleared by opening the cover. • Close lid completely. • Check lid striker (see section 8.1). • Check latch microswitch (see section 8.4).
HEAd	No rotor installed. Message is cleared by opening the cover. • Install a rotor.
PFAIL	Power failure detected during run. Message is cleared by pressing the STOP key. • Continue normal usage. If problem recurs, see section 10.1, and verify Logic PCB revision of at least rev. 2. • Check power circuit - power entry module, line filter, etc. (see section 9.2).
Err1	No signal from the tachometer has been sensed. Message is cleared by unplugging the centrifuge. • After unplugging, applying power and attempting another run, if the error recurs, spin the rotor by hand and watch for a tachometer (speed) indication. If none is displayed, check the Speed Sensor (see section 11.2). • If a tachometer (speed) indication is displayed, check the PCB fuses, and motor. (see sections 10.1, and 11.1).
OSPd	Overspeed. Rotation above 15,200 RPM has been detected. Message is cleared by unplugging the centrifuge. • After unplugging, applying power and attempting another run, if the error recurs, check the Power PCB (see section 10).
rEFr	Refrigeration failure. Measured temperature exceeds 45 degrees C. After unplugging, apply power and close the lid. Select a temperature colder than ambient and start a run. If the compressor does not function (chamber does not cool): • The Power PCB COMP LED (DS2 - green) should be lit. If not, check the Logic PCB (see section 10). • Check the solid state relay mounted to the baseplate (see section 12.3). • Check the condensing unit and associated electrical components (See section 12).
FSAFE	Hardware fail-safe feature “timed out”. • After unplugging, applying power and attempting another run, if the error recurs, check the Logic PCB and the Power PCB (see section 10).
COP	COP (Computer Operating Properly) watchdog feature is not enabled. • After unplugging, applying power and attempting another run, if the error recurs, check the Logic PCB (see section 10).
COPF	COP watchdog feature has “hung up” or “crashed”.. • After unplugging, applying power and attempting another run, if the error recurs, check the Logic PCB (see section 10).
ILLOP	Illegal operation. Program has “crashed”. • After unplugging, applying power and attempting another run, if the error recurs, check the Logic PCB (see section 10).
UndFl	Undefined Interrupt. May be the result of improper microprocessor configuration, improper program execution, or electrical noise. • After unplugging, applying power and attempting another run, if the error recurs, check the Logic PCB (see section 10).
Cover won’t open	• Listen for solenoid when COVER OPEN is pressed. If no sound is heard, check solenoid (see section 8.4) and/or the Power PCB (see section 10). • Power PCB COVER LED (DS5 - red) should be lit when COVER OPEN is pressed. If not, check the Logic PCB (see section 10).
No Braking	• Check that brake is selected. • Verify operation by measuring the stop time with and without the brake. See section 11.3 if with brake time is not less than without brake time. • Power PCB BRAKE LED (DS4 - red) should be lit during braking. If not, check Logic PCB (see section 10).

8 CABINET

8.1 Cover Assembly

The cover assembly contains the blue plastic outer lid, white painted metal lid liner, hinge springs (2), hinge rod, and latch striker. Early models had a fixed (non adjustable) striker. The adjustable striker can be installed using kit no. 50782A (ventilated) or 50782B (RF models). The striker may require adjustment if a Lid warning appears frequently.

Strike Adjustment

To adjust the cover latch striker:

1. Loosen the locking nut that holds it in place.
2. Adjust the striker by screwing it up or down, to correct its height for locking.
3. Be sure to lock it back into place by tightening the locking nut with a wrench. This will prevent it from loosening when the unit is in operation.

A properly adjusted cover will result in no Lid warning and no air leakage around the sides and front of the cover. If this adjustment does not resolve the Lid message, latch switch adjustment may be required. To check the latch switch alignment, refer to Section 8.4.

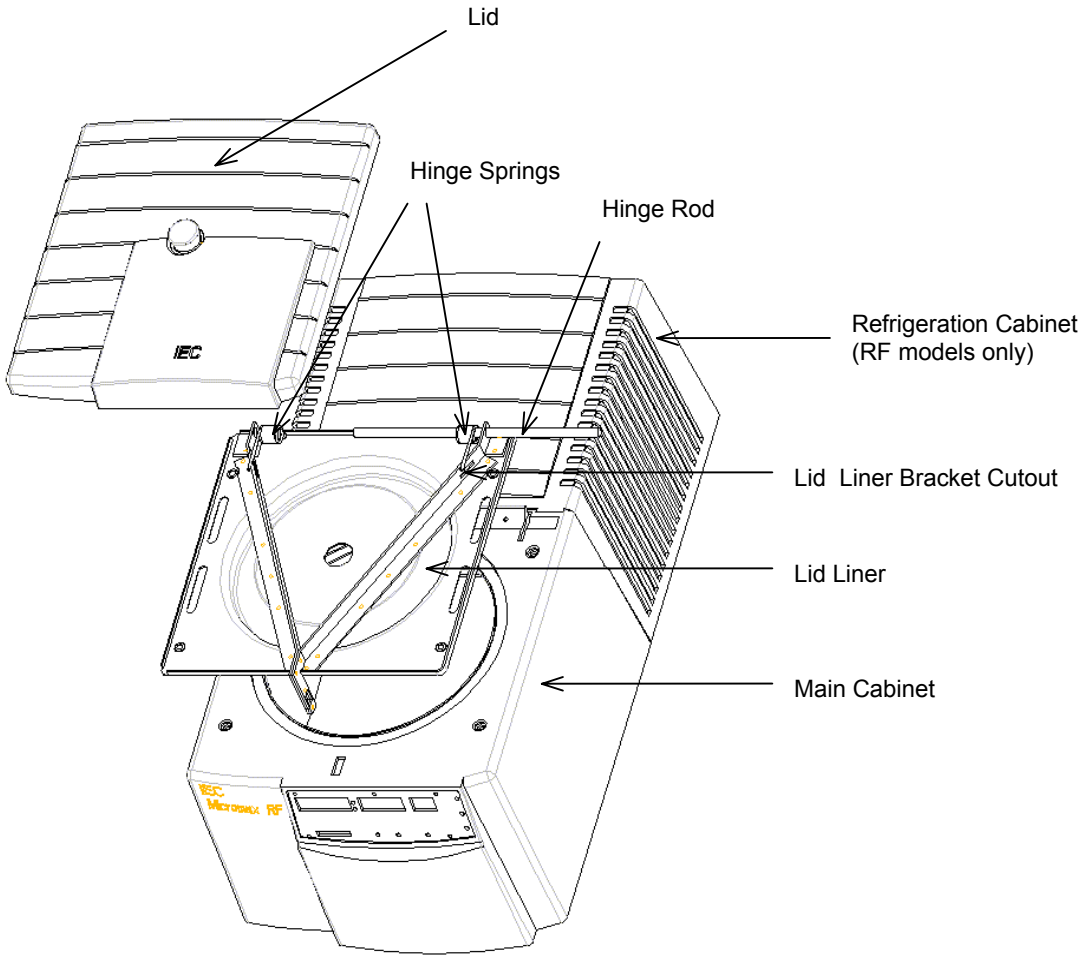
Most service to the unit requires the removal of the cover (lid) and cabinet, as described in the following procedures.

Cover Removal

To remove the cover assembly:

1. Open the cover and unplug the centrifuge.
2. Remove (4) Phillips head screws which attach blue lid to lid liner.
3. Remove the blue lid, while supporting the lid liner.
4. With lid liner raised to remove pressure from the hinge springs, remove spring arms from the cutouts in the lid liner bracket.
5. Remove hinge rod by sliding to the right or left, and remove springs and lid liner.

   Note - the two hinge springs are not identical, and can only be properly installed one way.



8.2 Cabinet Housing

Rear Cabinet Section (Refrigerated Units Only)

1. Unplug the centrifuge.
2. Remove (2) screws located on the back of the rear cabinet section.
3. Lift the back of the rear cabinet section away from the base plate of the unit.
4. Remove the rear cabinet section by gently disengaging the two tabs that connect the rear cabinet section to the front cabinet section.

Main Cabinet (All Units)

1. Remove lid per section 8.1.
2. Remove (4) screws located on the top of the cabinet. (This may require removal of a warning label. Be sure to re-apply the label when finished.)
3. On non-refrigerated units, remove (2) screws located on the back of the cabinet. On RF models, remove rear cabinet as mentioned above.
4. Gently lift cabinet partially off of the unit to allow access to the display board ribbon cable and ground wire.

WARNING: **At this point it is possible to directly contact the unit's circuit boards and other electronic components. The unit must be unplugged to prevent injury, and the service technician must be grounded. Any contact to the circuit boards without proper grounding can result in damage to components.**

WARNING: **During certain troubleshooting procedures it is necessary to activate the unit with the cabinet partially removed, so that the control panel is still plugged in. Extreme care must be taken to avoid electrical shock.**

5. Disconnect ribbon cable and ground wire. (When reconnecting, reposition the ribbon cable in the tie-down clip mounted on the inside surface of the cabinet. This prevents damage to the cable from the latch mechanism.)
6. Remove cabinet. If operation is required with the cabinet removed, lie the cabinet down on its side while keeping the Display PCB connected.

Lid and Cabinet are replaced by reversing the steps above.

8.3 Gasket(s)

The lid liner engages cover gasket(s) on both units. There is one horizontally mounted and one vertically mounted cover gasket around the guardbowl edge.

Additionally, in RF models, the is a gasket located between the cabinet and the guardbowl. This gasket prevents any water (melted frost) from getting into the electrical portions of the centrifuge. If any gap is visible, the gasket should be replaced, or the gap filled with silicon RTV.

8.4 Latch Assembly

The latch assembly consists of the latch, solenoid, microswitch, plunger/linkage arm assembly, and emergency release cord. The latch closes in two stages, and must be fully closed (two "clicks") in order to run the centrifuge. By sensing the position of the plunger/linkage arm connecting pin, the microswitch prevents operation of the unit when the lid is open. If an attempt is made to run the unit in this condition, "Lid" error message is displayed on the control panel.

If a "Lid" error message can not be cleared by fully closing the lid, the strike or microswitch may need adjustment. See Section 8.1, Cover Assembly, for strike adjustment instructions.

Checking the Microswitch

The microswitch can be tested using the following procedure:

1. Remove the lid and cabinet (see Sections 8.1 & 8.2).
2. Disconnect connector J/P7 on the logic board (upper board).
3. Measure the resistance across the two microswitch terminals
   - The switch should read open, when the latch is open.
   - The switch should read closed, when the latch is closed.

   If the readings are not as expected, the switch is either bad, or a component is not properly positioned.
4. To test the switch itself, open the latch and actuate the microswitch. Resistance readings should be as described above.
5. Make sure the latch, solenoid and microswitch are securely mounted, and that linkage pin engages with the microswitch actuator arm from below.
6. If necessary, bend the microswitch actuator arm to adjust its position so that the readings described in step 4 are obtained.

Solenoid

The solenoid activates release of the latch, when the STOP/COVER OPEN button is pressed, and the rotor has slowed below 150 RPM.

Checking the solenoid:
Resistance of the solenoid coil should be approximately 75 - 80Ω. This can be measured by at J/P12 connector on the power board (lower board) and measuring across the two WHT leads. If the coil resistance is not as expected, replace the solenoid.

To replace a faulty solenoid:
1. Remove the lid and cabinet (see Sections 8.1 & 8.2).

2. Disconnect the wiring to the solenoid at J/P12 on the Power PCB.
3. Remove the retaining nut that secures the solenoid to the containment frame.
4. Leaving the plunger and linkage arm assembly in place within the latch, remove the solenoid.
5. Slide the new solenoid onto the plunger.

Note: The pin that attaches the solenoid plunger to the linkage arm must be positioned below the microswitch arm in order to properly function, and to indicate lid open and lid closed conditions.

6. Carefully apply thread sealant, such as Loctite ® 242, to the solenoid threads and secure the retaining nut.
7. Reattach the wiring harness.

Checking power to the solenoid:

WARNING: The following procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the lid and place the cabinet on its side, leaving the display board connected.
2. Power to the solenoid can be measured at J/P12, across the two white leads. The expected value is 170 volts DC.
3. Close the cover and press the Stop/Open cover button, to activate the solenoid. Power is applied for a fraction of a second. Digital multimeters with peak hold should show approximately 130 VDC. .

9 POWER CIRCUIT

9.1 General

Power is supplied to the unit through the Power Entry Module, located on the back of the unit. The Power Entry Module contains a removable fuse tray containing one or two active fuses, depending on the model number (see section 2.3). In models requiring only one active fuse, a spare fuse is stored in the fuse tray for convenience.

A line filter, transformer, and terminal block are present in the RF models.

9.2 Troubleshooting

AC power

Use the following procedure to verify AC power to the boards and board components:

WARNING: This procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the lid and cabinet (see Sections 8.1 & 8.2).
2. With power applied, and using TP1 (GND) for ground, measure the voltage at:

    - TP4 170 VDC
    - TP3 +15 VDC
    - TP2 +5VDC

If voltage is not present, use the wiring diagram to trace back through the fuse(s), transformer, line filter, and power entry module, to locate any failed components or loose wires.

Fuse

If a main fuse blows repeatedly, an internal short needs to be found and corrected. Several spare fuses are required for troubleshooting. Follow this procedure to isolate the cause of a fuse that keeps blowing:

1. Remove lid and cabinet.
2. Remove all connectors at the power board. This includes J8, J9, J10, J11, J12, J13 and J14A, B & C.
3. Plug in the unit. If the fuse blows, check each component from the power entry module to the power board for shorts, and replace as necessary.
4. If no short is found, unplug the unit.
5. Connect the power board to the incoming supply (J9 of Power PCB), and leave all other connectors to the Power PCB disconnected.
6. Plug in the unit.
7. If the fuse blows, replace the power board.
8. Plug components in to the power board one at a time, unplugging and plugging in the unit each time, until the fuse blows. Search for a short in the last component connected before the fuse blew.

Note: for refrigerated units, the refrigeration system will often need to be turned on in order to find a short in the compressor.

10 CIRCUIT BOARDS

10.1 General

Motor Drive

The Micromax electronics consist of three circuit boards, the display board, logic board and the power board.

The display board contains the user interface and display components, including an encoder (U6), inverters (U2 & U5), as well as the display drivers (U1, U3, U4). The membrane keyboard and user interface displays are integral to the embedded system design and are under full microprocessor supervision.

The microcontroller (Logic) circuit board consists of the controlling microprocessor (U5, 68HC11 microcontroller) and associated system software (U12 - 27C256 EPROM). The microcontroller is an embedded system design. It is an eight bit machine with synchronous ports for data and address busses. It also has synchronous and asynchronous serial ports, an eight bit general purpose I/O port, and a four input eight bit analog to digital converter.

U1 is an under voltage sensing circuit which monitors power interruptions, displaying a PFAIL error message when logic voltage drops.

The Power circuit board develops the motor and logic power supply voltage. In addition to the motor drive circuit, the power board supports the following systems: refrigeration, condenser fan, latch solenoid, and the motor brake.

The drive motor is a brushless DC motor. Power is applied to the motor by the 3 phase sequencing of 6 MOSFET transistors (Q5 & Q6, Q7 & Q8, Q9 & Q10) through their associated drivers (U10 & U11, U12 & U13, U14 & U15). Only one pair of the MOSFETS is on at any given time.

Refrigeration

The compressor and condenser fan are both powered through solid state relays (SSR), the compressor through a baseplate mounted SSR and the condenser fan through a power board mounted SSR (U1). Both should be on , along with their corresponding power board LEDs COMP (DS2 - green) & FAN (DS1 - green), whenever cooling is called for.

Latch Solenoid

The cover solenoid is powered by MOSFET Q3. The cover solenoid may only be activated once the rotor has slowed to below 150 rpm.

10.2 LEDs & Test Points

Power PCB LEDs

These are the names and descriptions of the power board Controls and their corresponding LEDs:

FAN (DS1): This green LED Indicates that the condenser fan is activated.

COMP (DS2): This green LED indicates that the refrigeration drive circuit is activated. The refrigeration drive circuit includes the compressor.

FAULT (DS3): This red LED indicates when the motor is at rest. The FAULT LED measures the level of current being applied to the motor during acceleration. This LED is OFF at a steady state speed.

BRAKE (DS4): The red LED indicates when the brake circuit is activated.

COVER (DS5): This red LED indicates when the solenoid is activated.

PCB Test Points

PCB Test Points are as follows:

Power PCB	
TP1	GND
TP2	+5VDC
TP3	+15VDC
TP4	+HV (170VDC)
TP5	OSC (15 Khz)
TP6	Tach (1Hz/10RPM)

10.3 Replacing the Circuit Boards

Caution: **The circuit boards contain electronic devices that can be damaged by static electricity. Service personnel should be properly grounded (such as by wearing a wrist strap) whenever handling or touching the circuit boards or individual components. When transporting a circuit board, always enclose it in a static-protective bag.**

Display Board **The display board is located on the inside front surface of the main cabinet, directly beneath the control panel. Remove as follows:**

1. Remove the lid and cabinet (see Sections 8.1 & 8.2).
2. Disconnect all connectors from the board.
3. Remove the 5 Phillips head screws that secure the board.
4. Lift the board off.
5. Replace the board by reversing steps 1 - 4.

Logic Board **The logic board is located inside the unit, beneath the rotor and guardbowl assembly. It is mounted above the power board on standoffs. Remove as follows:**

1. Remove the lid and cabinet (see Sections 8.1 & 8.2).
2. Disconnect all connectors from the board.
3. Unclip each corner of the board from the standoffs, using gentle but firm pressure. Access to the board is possible from either the front of the unit or through the cutout in the sheet metal frame that supports the guardbowl assembly.
4. Lift the board off.
5. Replace the board by reversing steps 1 - 4.

Note:
A recent product improvement to the Micromax series was the addition of a *PULSE* button on the front Membrane Control Panel. This feature allows the user to make a quick spin, lasting as long as the *PULSE* button is pressed. This improvement requires a simultaneous software upgrade to at least revision 3.0. If the software change is not made at the same time the Control Panel is upgraded, then the *PULSE* button will act as the Cover Open button. If the new software is installed on a unit having no *PULSE* button, then the Cover Open button starts a short spin which ends when the button is released.

For ordering spares, use the following guidelines:

Part Description	NO PULSE Feature	PULSE Feature
Logic PCB	44476 Kit	50615
Control Panel (Ventilated)	50595A Kit	50614A
Control Panel (RF)	50595B Kit	50614B

The 44476 Kit will include a 50615 PCB with the older software (revision 2.7) already installed. This PCB works with the original panel that does not have a *PULSE* button.

The 50595 Membrane Control Panel Kit will include a 50614 Membrane Panel, an EPROM (software version of at least 3.0), and instructions on how to install the software on the original Logic PCB. This kit will upgrade a non *PULSE* button unit to one with the *PULSE* feature.

Power Board

The power board is mounted on the base of the unit, below the logic board. Remove as follows:

1. Remove the lid and cabinet (see Sections 8.1 & 8.2).
2. Remove logic board per instructions above.
3. Disconnect all connectors from the power board.
4. Unscrew the 5 plastic standoffs that secure the board to the base. Access to the standoffs is possible from either the front of the unit or through the cutouts in the sheet metal frame that supports the guardbowl assembly.
5. Remove the 4 screws that secure to clamp bar to the base.
6. Remove 1 screw that secures the front right corner of the board to the base.
7. Lift the board off. It may be easier to remove the PCB by first removing the solenoid (see section 8.4).
8. Replace the board by reversing steps 1 - 7.

CAUTION: **Mosfet devices are mounted on the underside of the front edge of the power board. These devices generate heat. They must be in good thermal contact, but electrically isolated from the aluminum heat sink. The silpad material that is between the Mosfets and the heat sink must be clean and undamaged when reinstalling the board. If your model does not have a heat sink, order IEC KIT NO. 44475 to replace the PCB and add the heat sink.**

11 DRIVE ASSEMBLY

11.1 Motor

The Micromax utilizes a brushless DC drive motor with built in Hall effect speed sensors.

Some electrical motor characteristics can be checked, when the unit is unplugged. These procedures are outlined in this section.

Test

To measure the resistance of the motor, use the following procedure:

1. Remove the lid and cabinet (see sections 8.1 & 8.2).
2. Remove connector J/P14A (red), J/P14B (brown), and J/P14C (orange) from power board.
3. Measure the resistance between each pair of wires (red/brown, red/orange, brown/orange). Expected resistance value is approximately 1Ω.
4. If an open circuit is detected, or if any lead does *not* read open with respect to ground, replace the motor.

Motor Replacement

Use the following procedure to replace the motor:

1. Remove the lid and cabinet (see section 8.1 & 8.2).
2. Remove the rotor.
3. Remove the rotor adapter. The adapter is removed by loosening the two Allen screws (3/32") in it and lifting it off.
4. Remove the black rubber motor boot. The motor boot is a molded part which has a channel that fits onto the guardbowl (no adhesives hold it in place). To remove it, grab a portion and peel it away from the guardbowl.
5. Disconnect motor wires from power board at J/P13, J/P14A, J/P14B, and J/P14C.
6. The brake resistor wires may be ty-wrapped to the motor wires. If so, cut and remove the ty-wraps.

7. Turning the unit on its side*, remove the 4 screws from the motor mounting plate. These are accessible through the hole in the unit's base plate.
8. Partially lift the motor out through the opening in the guardbowl.
9. Reach through the opening in the guardbowl and disconnect the motor ground wire from the base of the motor.
10. Replace the motor in the same fashion, reversing the steps.

***Caution**: On RF models, once the centrifuge has been turned over on its side, and the returned to its normal position (on all four suction cup feet) it must be allowed to stand for 24 hours before use. Serious refrigeration system damage can result if the compressor oil is not allowed to completely settle.

11.2 Speed Sensor

The Speed sensor is a set of three hall effect type sensors located at the bottom of the motor. It does not require calibration or adjustment. Its accuracy (+/- 10 rpm) can be verified by strobing the motor shaft through the viewport in the cover. It is integral to the motor and replacement requires replacement of the motor as a unit.

The sensor(s) and magnetic disk can be inspected by removing the cover at the bottom of the motor (2 screws). This sensor indicates not only the speed of rotation, but also position of the armature for the powering of the three phases at maximum efficiency. The sensor disk should not be loose, with respect to the shaft. This disk is mounted and fixed to the motor shaft at a specific location, and is synchronized to the armature. If its location (relative to the shaft) has changed, the motor will be misfiring and unable to attain maximum speeds. This requires replacement of the motor, as synchronization in the field is not possible.

The sensor(s) are located on the small printed circuit board within the motor. All three should be located with good proximity to the magnetic disk. If any gap appears to be too great the sensors can be carefully manipulated back towards the disk. Take care not to locate them too close, as the disk may rub on and damage them.

Test

WARNING: This procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the lid and place the cabinet on its side, leaving the display board connected.
2. Power to the speed sensor can be verified across test points TP1 (GND) and TP6 (Tach) of the Power PCB.
3. Turning the motor shaft slowly should produce a fluctuation between 0 and 5VDC (square wave).
4. The frequency output of the speed sensor can be measured across the same points using an oscilloscope or a multimeter with frequency capability. The speed sensor produces a frequency signal of 1 Hz/10RPM.

The speed sensor is an integral part of the motor assembly, and is not available separately. If tests to the speed sensor uncover a fault, the motor must be replaced (see Section 11.1).

11.3 Brake

The brake applies reversed voltage to the motor during deceleration.

The brake requires service if, with a fully loaded rotor and operating at that rotor's maximum allowable speed, the deceleration time in the brake mode is not less than the deceleration time in coast (no brake).

Test

Use this procedure to verify operation of the braking system:

WARNING: This procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the lid and place the cabinet on its side, leaving the display board connected.
2. Locate TP1 (GND) and J11, pin 3 (YEL) on the Power PCB.
3. Verify DC braking voltage across these locations. Expected measurement should be approximately 170 VDC.
4. Plug the unit in and verify that a properly loaded rotor is installed.
5. Select an appropriate speed and time, and start a run.
6. During a run, this voltage should drop slightly (3 - 10 VDC).
7. If voltage is not present, verify resistance of the brake resistor at J11 pins 1 (RED) and 3 (YEL). The expected value is approximately 50Ω.
8. If the resistor is good, replace the Power PC board.

12 REFRIGERATION

12.1 General

The Refrigerated Micromax is capable of maintaining a guard bowl temperature of 4° C at ambient temperatures up to 22° C. The units should be able to maintain those temperatures within ± 2° C of the set point. The unit is charged with 3.9 oz. of HP62 (R-04A) refrigerant.

Note: The compressor has a 60 second time delay before re-starting.

Both refrigerated and ventilated models require ventilation for proper air flow. Allow a minimum of 8 cm (3 inches) clearance on all vented sides of the unit. Insure that the condenser fins and ventilation grill are free of dust and dirt. Do not operate the refrigeration system, if the condenser fan is not working correctly.

The compressor in the refrigerated unit is controlled by a solid state relay. The solid state relay acts as a switch which receives a low voltage signal (5VDC) from the Power PC board to either turn it on or off. The signal originates at the Logic PC board and passes through the Power PC board which then supplies the low voltage and low current signal to the solid state relay coil. The relay contact is then made, providing 120VAC to the compressor, turning it on. If the 5VDC signal from the Power PC board or the Logic PC board is lost, the compressor will shut off.

12.2 Condensing Unit

Service of the condensing unit should be performed by qualified personnel only, with the proper refrigerant recovery systems.

The condensing unit consists of the compressor, the condenser fan and their related electrical components.

Test

Use the following procedure, to verify voltage to the compressor:

WARNING: This procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Unplug the unit.
2. Remove lid and place the cabinet on its side, leaving the control panel plugged in.
3. Plug in the unit.
4. Close the latch.
5. Set temperature below ambient. The compressor should turn on within one minute. Use a voltmeter to measure the AC voltage at the electrical box across the BLU and BLK wires which go directly into the compressor.
6. The voltage applied to the compressor should be approximately 120 volts AC (or the actual in-line voltage).
7. If voltage is present, but the compressor does not start, check the starting capacitor.
8. If voltage is not present and the COMP LED on the Power PC board is lit, check the solid state relay (see Section 12.3).

To verify voltage to the condenser fan:

WARNING: This procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the refrigeration cabinet.
2. Measure across the two leads to the fan (WHT & ORG).
3. When cooling is called for, this should read approximately 120 VAC.

12.3 Refrigeration Relay

The solid state relay (SSR) powers the compressor on a low voltage signal from the Power PCB. To test the SSR, use the following procedure:

WARNING: This procedure requires operation of the unit with power applied and the cabinet removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Unplug the unit.
2. Remove lid and place the cabinet on its side, leaving the control panel plugged in.
3. Plug in the unit.
4. Close the latch.
5. Measure the DC voltage across J10 of the Power PCB, pins 1 (RED) and 2 (GRY). When the refrigeration system is activated (COMP LED - DS2 green is lit), there should be 5 VDC present. If not, replace the Power PCB.
6. If the 5 VDC is present, verify the voltage at the compressor. If voltage of 120VAC is not found at the compressor, check the Pressure Switch and look for any loose connections. If everything seems good, replace the relay.

12.4 Thermistor

The thermistor is located inside the chamber of the refrigerated model, beneath the rotor. You can verify its operation by taking its resistance at various temperatures. Follow this procedure to do so:

1. Open the cover.
2. Unplug the unit.
3. Remove the lid and cabinet (see Sections 8.1 & 8.2).
4. Locate J/P5 connector, on the Logic board and disconnect it.
5. Measure the resistance across the two pins.

- At 25° C (approx. room temperature) the resistance should be 2.25 kΩ.
- At 0° C (achieved by packing ice around thermistor) the resistance should be 7.35 kΩ.

If these values are not verified, or if an open or short circuit are detected, the thermistor should be replaced.

Replace

Use the following procedure to replace the thermistor:

1. Open the cover.
2. Unplug the unit.
3. Remove the lid and cabinet (see Sections 8.1 & 8.2).
4. Remove rotor.
5. Locate the thermistor inside the guardbowl. The thermistor is held in place with a rubber grommet. The body of the thermistor can be accessed through the cutout in the side of the guardbowl containment frame.
6. Push the thermistor down through the bottom of the guardbowl.
7. Unplug the thermistor from the logic board 44476, at J/P 5.
8. Install the new thermistor by reversing the steps above. The tip of the thermistor should be located approximately 1/2 inch above the surface of the guardbowl.

12.5 Pressure Switch

The refrigerated units also include a pressure switch. This pressure switch acts as a safety device for the refrigeration system. The pressure switch is brazed into the high pressure tubing run between the compressor and the condenser. If the pressure in the refrigeration system exceeds a pressure of 500 psi, the pressure switch will 'open', shutting the compressor off.

Replacement of the pressure switch should be done by a qualified refrigeration person.

13 DRAWINGS

Drawings included in this section are:

3590	Micromax, Ventilated (3 Pages)
3592	Micromax, Refrigerated (3 Pages)
10878	System Schematic, Ventilated Micromax
10872	System Schematic, Refrigerated Micromax
10873	Display Board Schematic
44474	Display Board Layout
PL44474	Display Board Parts List
10874	Motor Drive Board Schematic (2 Pages)
44475	Motor Drive (Power) Board Layout
PL44475	Motor Drive (Power) Board Parts List
10876	Logic Board Schematic (2 Pages)
50614	Logic Board Layout
PL50614	Logic Board Parts List

Note: At time of publication, these drawings were accurate. Changes do occur. If you have any questions regarding these drawings, contact IEC Technical Support at +(781) 449-8060.

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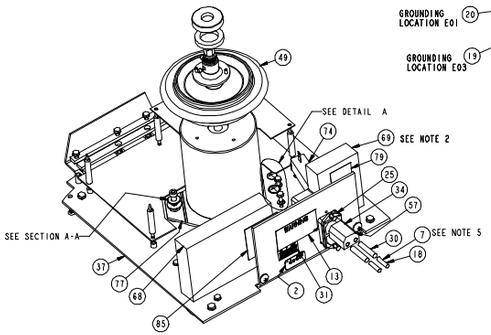
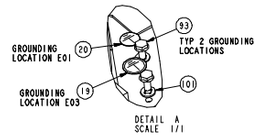
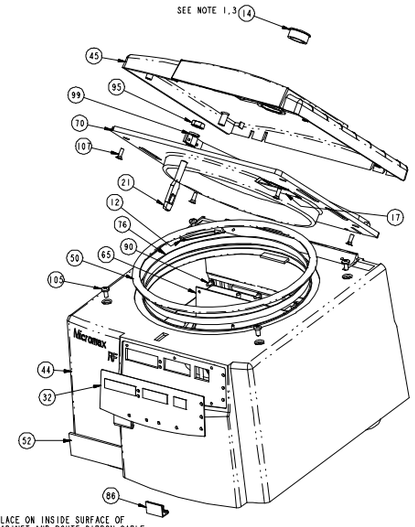
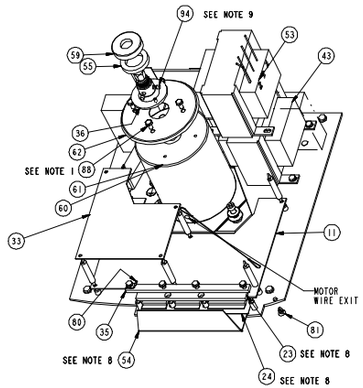
REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE

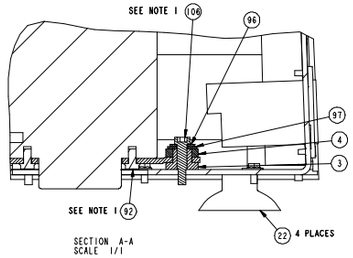




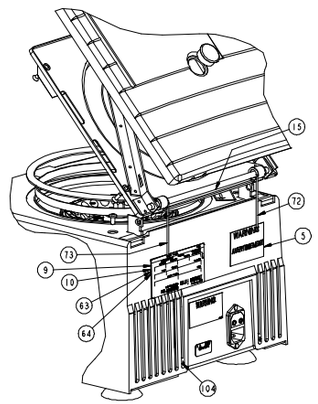
DETAIL A
SCALE 1/1

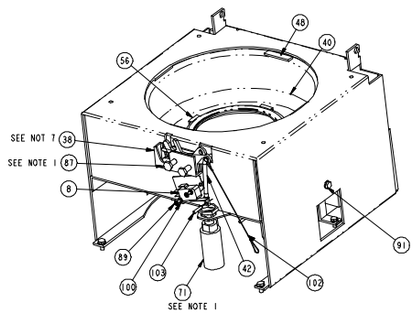

SEE NOTE 1,3
PLACE ON INSIDE SURFACE OF CABINET AND ROUTE RIBBON CABLE (#50602) AND DISPLAY BOARD GROUND WIRE (#50605B) THROUGH CLIP

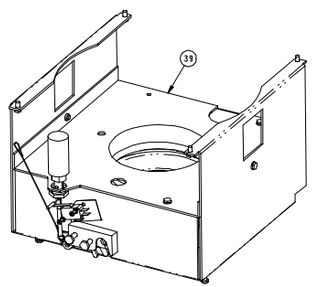




SECTION A-A
SCALE 1/1







			MATERIAL:	PARTS LIST. SEE PL:	
			FINISH:	ThermoIEC	
			UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH REMOVE ALL BURRS & SHARP EDGES SURFACE QUALITY √	TITLE: MICROMAX, VENTILATED	
ASSY. NO.	USED ON APPLICATION			SIZE: E	CODE ID. NO.
	BY	DATE		DRAWING NO. 3590	REV. 16
DRAWN			TOLERANCES 2 PLACE DEC. ±.02 3 PLACE DEC. ±.005 ANGLES ±1/2°	SCALE: 1/2	SHEET 2 OF 2
CHECKED					
APPROVED					

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ITEM	QTY	PART NO.	DESCRIPTION		
1	1	10870	SYSTEM SCHEMATIC, VENTILATED	BULK ITEM	NOT SHOWN
2	1	40346	***SEE TABLE ***LABEL, FUSE SLO/BLO 250V	PART	
3	3	40748	BARRY MOUNT, BUSHING	PART	
4	3	40749	BARRY MOUNT, RING	PART	
5	1	41170	***SEE TABLE ***LABEL, HIGH LEAKAGE	PART	
6	1	43312	***SEE TABLE ***POWER CORD, INT'L	PART	
7	2	43689	***SEE TABLE ***FUSE, TYPE T, 4A	PART	
8	1	43754	MICROSWITCH	PART	
9	1	44102	***SEE TABLE ***DATA PLATE FORMA	PART	
10	1	44105	***SEE TABLE ***DATA PLATE-FORMA	PART	
11	1	44475	POWER BOARD ASSY	PART	
12	1	45274	LABEL, ROTATION	PART	
13	1	45995	LABEL, WARNING	PART	
14	1	48118	VIEWPORT, HEYCO#1312	PART	
15	1	48380	HINGE PIN	PART	
16	1	49856	***SEE TABLE ***ROTOR LID	PART	
17	1	50011	LABEL, CAUTION	PART	
18	2	50021	***SEE TABLE ***FUSE, 10A	PART	
19	1	50127	LABEL PROTECTIVE EARTH GROUND SYMBOL	PART	
20	1	50128	LABEL SECONDARY CHASSIS GROUND SYMBOL	PART	
21	1	50146	STRIKE	PART	
22	4	50148	SUCTION FOOT	PART	
23	1	50533	INSULATION PAD	PART	
24	1	50534	SILPAD, PC BD	PART	
25	1	50537	***SEE TABLE ***POWER ENTRY MODULE	PART	
26	1	50600	BRAKE HARNESS	PART	NOT SHOWN
27	1	50601	LOGIC BOARD HARNESS	PART	NOT SHOWN
28	1	50602	DISPLAY BOARD HARNESS	PART	NOT SHOWN
29	1	50603	COVER, HARNESS-MICROMAX	PART	NOT SHOWN
30	2	50606	***SEE TABLE ***FUSE, 1/4 X 1 1/4	PART	
31	1	50611	***SEE TABLE ***LABEL, FUSE TYPE T, 250V	PART	
32	1	50614	***SEE TABLE ***MEMBRANE PANEL	PART	
33	1	50615	***SEE TABLE ***LOGIC BOARD ASSY (W/ PULSE)	PART	
34	1	50619	***SEE TABLE ***FUSE DRAWER	PART	
35	1	50620	CLAMP BAR	PART	
36	1	50621	ROTOR ADAPTER ASSEMBLY	ASSEMBLY	
37	1	50623	BASE PLATE, VENTILATED	PART	
38	1	50628	LATCH, MICROMAX	ASSEMBLY	
39	1	50630	GUARDBOWL SHELF	PART	
40	1	50631	GUARD BOWL	PART	
41	1	50632	CONTAINMENT FRAME	PART	
42	1	50635	LINK ARM	PART	
43	1	50638	***SEE TABLE ***TRANSFORMER, REFRIGERATED UNIT (230V)	PART	
44	1	50639	***SEE TABLE ***MAIN CABINET	PART	
45	1	50640	***SEE TABLE ***LID	PART	
46	1	50645	PWR HARNESS, VENTILATED, DOM	PART	
47	1	50775	***SEE TABLE ***MOTOR MOUNTING PLATE	PART	
48	4	50778	COVER GASKET	PART	
49	1	50789	MOTOR BOOT	PART	
50	1	50897	O-GASKET, CLEAN SEAL (COVER)	PART	
51	1	53440	***SEE TABLE ***ROTOR 24 X 24 PLCS (1.5ML X 0.5ML)	PART	
52	1	56620	LABEL, FORMA MICROCENTRIFUGE (HP)	PART	
53	1	61268	***SEE TABLE ***TRANSFORMER, JAPANESE UNIT, 100V	PART	
54	1	63016	HEAT SINK	PART	
55	1	65231	WASHER, ROTOR	PART	
56	4	65302	INSULATION TAPE, VCT-1 1/8 X 2	PART	
57	1	65359	***SEE TABLE ***FUSE DRAWER	PART	
58	1	65687	***SEE TABLE ***POWER CORD	PART	
59	1	65690	NUT, RETAINER	PART	
60	1	65691	***SEE TABLE ***MOTOR	PART	

ITEM	QTY	PART NO.	DESCRIPTION		
61	1	65720	***SEE TABLE ***MOTOR	PART	
62	1	65726	***SEE TABLE ***MOTOR SHIELD	PART	
63	1	66003	***SEE TABLE ***DATA PLATE LABEL	PART	
64	1	66015	***SEE TABLE ***CSA-NRTL/C DATA PLATE	PART	
65	1	44474A	DISPLAY PCB	PART	
66	1	50605A	GROUND WIRE	PART	NOT SHOWN
67	2	50605B	GROUND WIRE	PART	NOT SHOWN
68	1	50608A	***SEE TABLE ***SOUND INSULATION	PART	
69	1	50608B	SOUND INSULATION	PART	
70	1	50617A	LID LINER ASSEMBLY	ASSEMBLY	
71	1	50634A	SOLENOID	ASSEMBLY	
72	1	50636-A	HINGE SPRING, RIGHT HAND WIND	PART	
73	1	50636-B	HINGE SPRING, LEFT HAND WIND	PART	
74	1	60430A	MOTOR BRAKE RESISTOR	PART	
75	1	COML	ADHESIVE LOCTITE 242	BULK ITEM	
76	1	COML	FOAM TAPE 3/8 X 1/16 THK. (REF 3M#4516 BLK)	PART	
77	6	COML	RICHCO #CBS-TW-22 STANDOFFS	PART	
78	1	COML	INSULATOR PAD, #ISPA177-V7	PART	
79	1	COML	ADCHEM TAPE #3175M-60-54, 2"X1 25"	PART	
80	1	COML	FASTON TAB, AMP #61385-1	PART	
81	1	COML	ARROW CLIP, HEYCO 0301	PART	
82	2	COML	ADVEL 01682-0412-28 RIVET (1/8x.44)	PART	
83	1	COML	BEARING, THOMSON #3L2-FF	PART	
84	1	COML	IN-LINE SPLICE ASST AMP #340035-1	PART	
85	1	COML	ADCHEM TAPE #3175M-60-54, 2"X2"	PART	
86	1	COML	PANDUIT FCC5-A-D0	PART	
87	2	H103114	1/4-20 X .880 HEX HEAD, SS	PART	
88	4	H103400	***SEE TABLE ***10-24 X .375 TRIM HEX HEAD W/SI8-8	PART	
89	2	H110105	4-40 X .025 PAN HEAD PHIL, SS	PART	
90	5	H110114	6-32 X 312 PAN HEAD PHIL, SS	PART	
91	10	H183313	10-32 X .375 WHIZ LOCK, ZN	PART	
92	4	H183315	10-24 X .375 WHIZ LOCK, ZN	PART	
93	11	H183318	8-32 X .375-WHIZ LOCK, ZN	PART	
94	2	H235106	10-32X.19 LG SET SCREW	PART	
95	1	H338101	5/16-18 HEX JAM NUT, SS	PART	
96	3	H401111	1/4" FLAT WASHER, SS	PART	
97	3	H402750	1/4" WASHER, TYPE B (.734 OD, .281 ID, .04 THK),SS	PART	
98	1	H414101	#6 INTERNAL LOCK WASHER, SS	PART	
99	1	H419102	5/16 LOCK WASHER SPLIT, SS	PART	
100	2	H424011	#4 INTERNAL LOCK WASHER, SS	PART	
101	2	H424103	#8 INTERNAL LOCK WASHER, SS	PART	
102	1	H509002	LATCH RELEASE CORD	PART	
103	1	H541108	ROLL PIN, 1/8 DIA, 5/8 LG SST	PART	
104	2	H555001	STAKE FASTENER, PS10F6CP504BG	PART	
105	4	H555002	STAKE FASTENER, S10F6CPS06BG	PART	
106	3	H732000	1/4X625 SHOULDER SCREW, AL ST	PART	
107	4	H900053	8-1/63500 PLASTITE FLAT HEAD, PHIL HD	PART	
108	1	OP_MANUAL	OPERATORS MANUAL	PART	NOT SHOWN
109	3	P0023	***SEE TABLE ***SHIPMENT PACKAGING, ROTOR	PART	NOT SHOWN
110	2	P0161	COVER FOAM	PART	NOT SHOWN
111	1	P0342	BAG, PACKAGING	BULK ITEM	NOT SHOWN
112	1	P0827	END PACK SET	PART	NOT SHOWN
113	1	P0830	CARTON	PART	NOT SHOWN

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	-	KFC	4/16/96	3416	KFC	5/14/96
1	-	KFC	5/21/96	3604	KFC	7/3/96
2	-	KFC	8/20/96	3636	KFC	8/20/96
3	-	KFC	11/4/96	3724	RAD	12/9/96
4	-	PL	2/4/97	3839	RAD	2/7/97
5	-	PL	2/13/97	3860	RAD	2/28/97
6	-	PL	3/7/97	3873	DMM	3/7/97
7	-	KMN	8/14/97	4007	RAD	8/29/97
8	-	KMN	9/17/97	4094	RAD	4/2/98
9	-	PL	6/16/98	4349	RAD	7/24/98
10	-	PL	4/25/99	4820	RAD	7/23/99
11	-	PL	7/18/00	5486	RAD	9/5/00
12	-	PL	12/6/00	5663	RAD	12/9/00
13	-	PL	4/10/01	5761	RAD	5/23/01
14	-	PL	10/23/01	5963	RAD	3/4/02
15	-	PL	3/8/02	6098	RAD	3/15/02
16	-	QHN	05/16/02	6170	QHN	08/08/02

TABULATION MODEL vs PART NO.

PART NO.	DESCRIPTION	PART NO.	3590	3590F	3591	3595	5520	5521	5525	5590	5591
40346	LABEL, FUSE SLO/BLO 250V	40346	40346L	40346L	N	40346N	40346L	N	40346N	40346L	N
41170	LABEL, HIGH LEAKAGE	41170	41170	41170	N	N	41170	N	N	41170	N
43312	POWER CORD, INT'L	43312	N	N	43312	N	N	43312	N	N	43312
43689	FUSE, TYPE T, 4A	43689	N	N	43689	N	N	43689	N	N	43689
44102	DATA PLATE FORMA	44102	N	N	N	N	N	44102D	44102E	N	44102N
44105	DATA PLATE-FORMA	44105	N	N	N	N	44105J	N	N	44105T	N
49856	ROTOR LID	49856	N	49856	N	N	N	N	N	N	N
50021	FUSE, 10A	50021	N	N	N	50021	N	N	50021	N	N
50537	POWER ENTRY MODULE	50537	50537A	50537A	50537B	50537A	50537A	50537B	50537A	50537A	50537B
50606	FUSE, 1/4 X 1 1/4	50606	50606B	50606B	N	N	50606B	N	N	50606B	N
50611	LABEL, FUSE TYPE T, 250V	50611	N	N	50611A	N	N	50611A	N	N	50611A
50614	MEMBRANE PANEL	50614	50614A	50614A	50614A	50614A	50614C	50614C	50614C	50614E	50614E
50615	LOGIC BOARD ASSY (W/ PULSE)	50615	50615A	50615A	50615A	50615A	50615B	50615B	50615B	50615A	50615A
50619	FUSE DRAWER	50619	50619B	50619B	50619A	N	50619B	50619A	N	50619B	50619A
50638	TRANSFORMER, REFRIGERATED UNIT (230V)	50638	N	N	50638	N	N	50638	N	N	50638
50639	MAIN CABINET	50639	50639A	50639A	50639A	50639A	50639	50639	50639	50639	50639
50640	LID	50640	50640A	50640A	50640A	50640A	50640B	50640B	50640B	50640B	50640B
50775	MOTOR MOUNTING PLATE	50775	50775	50775	50775	50775	50775A	50775A	50775A	50775	50775
53440	ROTOR 24 X 24 PLCS (1.5ML X 0.5ML)	53440	N	53440	N	N	N	N	N	N	N
56620	LABEL, FORMA MICROCENTRIFUGE (HP)	56620	N	N	N	N	56620A	56620A	56620A	56620B	56620B
61268	TRANSFORMER, JAPANESE UNIT, 100V	61268	N	N	N	61268	N	N	61268	N	N
65359	FUSE DRAWER	65359	N	N	N	65359	N	N	65359	N	N
65687	POWER CORD	65687	65687	65687	N	65687	65687	N	65687	65687	N
65691	MOTOR	65691	65691	65691	65691	65691	N	N	N	65691	65691
65720	MOTOR	65720	N	N	N	N	65720	65720	65720	N	N
65726	MOTOR SHIELD	65726	N	N	N	N	65726	65726	65726	N	N
66003	DATA PLATE LABEL	66003	N	N	66003DB	66003DF	N	N	N	N	N
66015	CSA-NRTL/C DATA PLATE	66015	66015C	66015C	N	N	N	N	N	N	N
50608A	SOUND INSULATION	50608A	50608A	50608A	N	N	50608A	N	N	50608A	N
H103400	10-24 X .375 TRIM HEX HEAD W/SI8-8	H103400	N	N	N	N	H103400	H103400	H103400	N	N
OP_MANUAL	OPERATORS MANUAL	OP_MANUAL	OM3590	OM3590	OM3590	OM3590	OM5520	OM5520	OM5520	OM5590	OM5590
P0023	SHIPMENT PACKAGING, ROTOR	P0023	N	P0023	N	N	N	N	N	N	N

NOTES:
1. APPLY LOCTITE 242 TO SHOULDER SCREWS, MOTOR TRIM HEX HEAD & WHIZ LOCK SCREWS, SOLENOID NUT, HEX HEAD SCREWS FOR LATCH, AND LATCH STRIKE
2. PERMANENTLY MARK "HOT" .625" HIGH, RED CHARACTERS CENTERED, ON TOP SURFACE OF RESISTOR (PART NO. 60430-A)
3. TIGHTEN NUT SO THAT FLAT ON NUT IS PARALLEL TO FRONT OF LID LINER.
4. GROUND USING WHIZ LOCK AND INTERNAL LOCK WASHER PER IEC SPEC. #35852 COLOR AS INDICATED IN REMARKS SECTION OF PARTS LIST
5. INSTALL ACTIVE FUSES IN FUSE DRAWER; PACK SPARE FUSES WITH OPERATOR'S MANUAL
6. ASSEMBLE MOTOR BOOT (#50637) WITH SS LUBE
7. ADD LUBRIPLATE AA TO INTERNAL LATCH ASSY
8. ADHERE SILPAD (50534) TO HEAT SINK (63016. ADHERE INSULATION PAD (50533) TO CLAMP BAR (50620)
9. APPLY LOCTITE 242 TO SETSCREW THREADS BEFORE ASSEMBLY. USE AS LITTLE AS POSSIBLE TO AVOID GETTING LOCTITE ON MOTOR SHAFT OR OTHER ADAPTER SURFACES.

PROENGINEER MODEL 3590.ASM

THIS ASSEMBLY DRAWING IS TO BE USED FOR ASSEMBLIES 3590, 3591, 3595, 5520, 5521, 5525, 5519

		MATERIAL:	PARTS LIST. SEE PL:
			ThermoIEC
3595	MMAX VENT	FINISH:	TITLE.
3591	MMAX VENT		MICROMAX, VENTILATED
3590	MMAX VENT	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY √	
ASSY. NO.	USED ON		
APPLICATION			
BY	DATE	TOLERANCES	SIZE: E; CODE ID. NO.; DRAWING NO. 3590; REV. 16
DRAWN KFC	2/8/96	X ±.02 ; 2 PLACE DEC. ±.010 ; 3 PLACE DEC. ±.005 ; ANGLES ±1/2	SCALE:3/4; SHEET 1 OF 2
CHECKED RAD	2/8/96		
APPROVED RAD	2/8/96		

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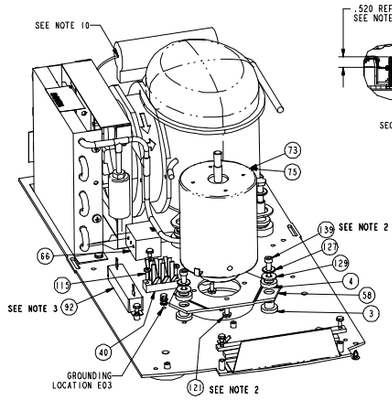
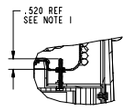
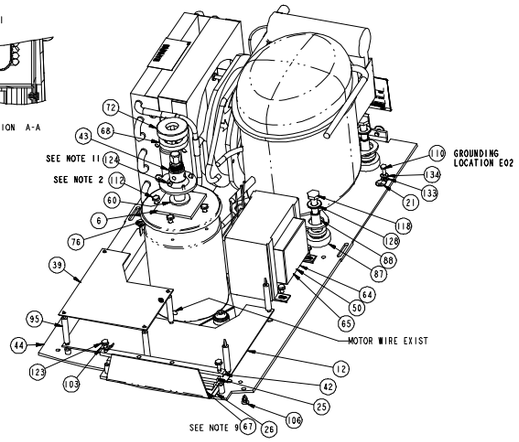
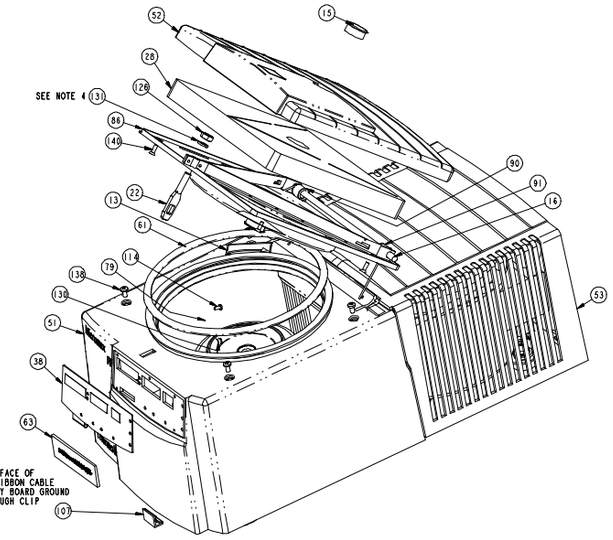
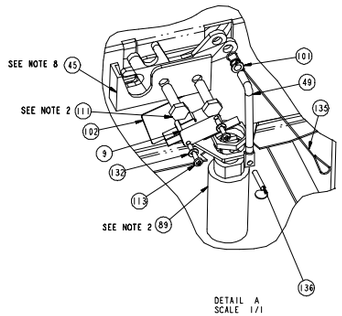
REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE

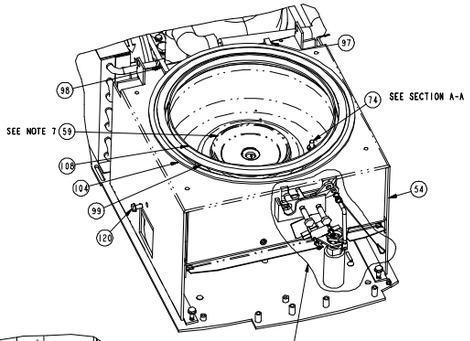


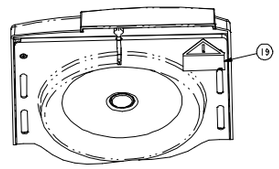


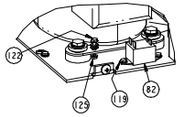


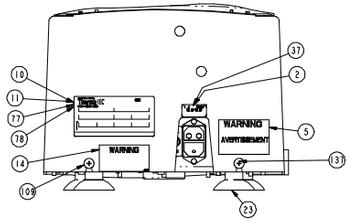

SEE NOTE 4
PLACE ON INSIDE SURFACE OF CABINET AND ROUTE RIBBON CABLE (#50602) AND DISPLAY BOARD GROUND WIRE (#50605G) THROUGH CLIP

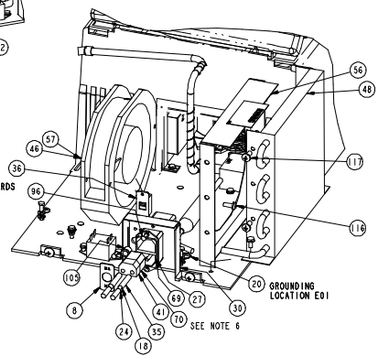


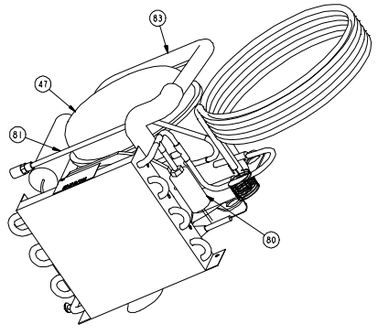












				MATERIAL:	PARTS LIST. SEE PL.	
					ThermoIEC	
				FINISH:	TITLE:	
				UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓	MICROMAX, REFRIGERATED	
ASST. NO.		USED ON			SIZE: E	CODE ID NO.
APPLICATION					DRAWING NO. 3592	REV. 17
	BY	DATE		TOLERANCES		
DRAWN	MFC	2/8/96		2 PLACE DECS. ± .03	3 PLACE DECS. ± .005	ANGLES ± 1/2°
CHECKED	RAD	2/8/96			SCALE: 1/2	SHEET 2 OF 2
APPROVED	RAD	2/8/96				

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REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
16	-	PL	03/11/02	6098	RAD	03/18/02
17	-	QHN	05/16/02	6170	QHN	08/08/02

ITEM	QTY	PART NO	DESCRIPTION		
1	1	10872	SYSTEM SCHEMATIC, REFRIGERATED	BULK ITEM	NOT SHOWN
2	1	40346	***SEE TABLE ***LABEL, FUSE SLO/BLO 250V	PART	
3	3	40768	BARRY MOUNT, BUSHING	PART	
4	3	40769	BARRY MOUNT, RING	PART	
5	1	41170	***SEE TABLE ***LABEL, HIGH LEAKAGE	PART	
6	1	43146	MOTOR TOP SEAL	PART	
7	1	43312	***SEE TABLE ***POWER CORD, INT'L	PART	
8	1	43335	***SEE TABLE ***VOLTAGE SELECTOR LABEL	PART	
9	1	43754	MICROSWITCH	PART	
10	1	44102	***SEE TABLE ***DATA PLATE FORMA	PART	
11	1	44105	***SEE TABLE ***DATA PLATE-FORMA	PART	
12	1	44475	POWER BOARD ASSY	PART	
13	1	45274	LABEL, ROTATION	PART	
14	2	45996	LABEL, WARNING	PART	
15	2	48116	VIEWPORT, HEYCO#3312	PART	
16	1	48380	HINGE PIN	PART	
17	1	49856	***SEE TABLE ***ROTOR LID	PART	NOT SHOWN
18	2	49998	FUSE, TYPE T, 10A	PART	
19	1	50011	LABEL, CAUTION	PART	
20	1	50127	LABEL, PROTECTIVE EARTH GROUND SYMBOL	PART	
21	2	50128	LABEL SECONDARY CHASSIS GROUND SYMBOL	PART	
22	1	50146	STRIKE	PART	
23	4	50168	SUCTION FOOT	PART	
24	2	50159	FUSE, 10.0A, 250V	PART	
25	1	50533	INSULATION PAD	PART	
26	1	50534	SILPAD, PC 88	PART	
27	1	50537	***SEE TABLE ***POWER ENTRY MODULE	PART	
28	1	50538	FOAM INSULATION, LID	PART	
29	1	50545	INSULATION TAPE, 1/8x1	PART	WRAP AROUND CAP TUBE
30	1	50596	POWER MODULE BRACKET	PART	
31	1	50600	BRAKE HARNESS	PART	NOT SHOWN
32	1	50601	LOGIC BOARD HARNESS	PART	NOT SHOWN
33	1	50602	DISPLAY BOARD HARNESS	PART	NOT SHOWN
34	1	50603	COVER, HARNESS-MICROMAX	PART	NOT SHOWN
35	2	50606	***SEE TABLE ***FUSE, 1/4 X 1 1/4	PART	
36	1	50609	***SEE TABLE ***VOLTAGE SELECTOR SWITCH	PART	
37	1	50611	***SEE TABLE ***LABEL, FUSE TYPE T, 250V	PART	
38	1	50614	***SEE TABLE ***MEMBRANE PANEL	PART	
39	1	50615	***SEE TABLE ***LOGIC BOARD ASSY (W/ PULSE)	PART	
40	1	50618	TERMINAL BLOCK	PART	
41	1	50619	***SEE TABLE ***FUSE DRAWER	PART	
42	1	50620	CLAMP BAR	PART	
43	1	50621	ROTOR ADAPTER ASSEMBLY	ASSEMBLY	
44	1	50622	BASE PLATE, REFRIGERATED	PART	
45	1	50626	LATCH, MICROMAX	ASSEMBLY	
46	1	50627	***SEE TABLE ***FAN	PART	
47	1	50628	***SEE TABLE ***COMPRESSOR	ASSEMBLY	
48	1	50629	CONDENSER	PART	
49	1	50635	LINK ARM	PART	
50	1	50638	***SEE TABLE ***TRANSFORMER, REFRIGERATED UNIT (230V)	PART	
51	1	50639	***SEE TABLE ***MAIN CABINET	PART	
52	1	50640	***SEE TABLE ***LID	PART	
53	1	50642	REFRIGERATION CABINET	PART	
54	1	50643	GUARD BOWL ASSEMBLY	ASSEMBLY	
55	1	50644	WIRING HARNESS, POWER - REF.	PART	NOT SHOWN
56	1	50646	CONDENSER SHIELD	PART	
57	1	50727	***SEE TABLE ***FAN	PART	
58	1	50775	***SEE TABLE ***MOTOR MOUNTING PLATE	PART	
59	1	50789	MOTOR BOOT	PART	
60	1	50790	DISC,MOISTURE	PART	

ITEM	QTY	PART NO.	DESCRIPTION		
61	1	50897	B-GASKET, CLEAN SEAL (COVER)	PART	
62	1	53440	***SEE TABLE ***ROTOR 24 X 24 PLCS (1.5ML X 0.5ML)	PART	NOT SHOWN
63	1	56620	LABEL, FORMA MICROCENTRIFUGE (HP)	PART	
64	1	61266	***SEE TABLE ***TRANSFORMER, 124V, 60 Hz	PART	
65	1	61268	***SEE TABLE ***TRANSFORMER, JAPANESE UNIT, 100V	PART	
66	1	62613	LINE FILTER ASSY	PART	
67	1	63016	HEAT SINK	PART	
68	1	65231	WASHER, ROTOR	PART	
69	1	65358	***SEE TABLE ***POWER ENTRY MODULE	PART	
70	1	65359	***SEE TABLE ***FUSE DRAWER	PART	
71	1	65687	***SEE TABLE ***POWER CORD	PART	
72	1	65690	NUT, RETAINER	PART	
73	1	65691	***SEE TABLE ***MOTOR	PART	
74	1	65692	TEMPERATURE SENSOR	PART	
75	1	65720	***SEE TABLE ***MOTOR	PART	
76	1	65726	***SEE TABLE ***MOTOR SHIELD	PART	
77	1	66014	***SEE TABLE ***DATA LABEL W/ REFRIGERANT	PART	
78	1	66016	***SEE TABLE ***DATA LABEL CSA-NRTL/C W/ REFRIGERANT	PART	
79	1	44474B	DISPLAY PCB	PART	
80	1	44689-A	TUBING ASSEMBLY DETAIL	ASSEMBLY	
81	1	44689-B	TUBING ASSEMBLY DETAIL	ASSEMBLY	
82	1	50597B	SOLID STATE RELAY	PART	
83	1	50604A	INSULATION, 3/8" ID X 3/16" THK, WALL	PART	
84	2	50605A	GROUND WIRE	PART	NOT SHOWN
85	1	50605B	GROUND WIRE	PART	NOT SHOWN
86	1	50617B	LID LINER ASSEMBLY	ASSEMBLY	
87	4	50628D	GROMMET	PART	
88	4	50628E	SLEEVE	PART	
89	1	50634A	SOLENOID	ASSEMBLY	
90	1	50636-A	HINGE SPRING, RIGHT HAND WIND	PART	
91	1	50636-B	HINGE SPRING, LEFT HAND WIND	PART	
92	1	60430A	MOTOR BRAKE RESISTOR	PART	
93	1	COML	ADHESIVE LOCTITE 242	BULK ITEM	
94	1	COML	LOCTITE 222	PART	
95	6	COML	RICHCO RCBS-1M-22 STANDOFFS	PART	
96	4	COML	ADVEL #1682-0412-28 RIVET (1/8x.44)	PART	
97	1	COML	FOAM,TAPE-GRAY-1/4 X 3/16THK	PART	
98	1	COML	FOAM,TAPE-RH	PART	
99	1	COML	FOAM,TAPE,BLK,3/8 X 1/16THK	PART	
100	1	COML	IN-LINE SPLICE ASSY ANP #340035-1	PART	
101	1	COML	BEARING, THOMSON #8JL2-FF	PART	
102	1	COML	INSULATOR PAD, #1SPA137-V2	PART	
103	1	COML	FASTON TAB, AMP #81365-1	PART	
104	1	COML	FOAM TAPE, 1/4X3/16 THK	PART	
105	1	COML	HEYCO OPEN/CLOSE BUSHING, #2065	PART	
106	1	COML	ARROW CLIP, HEYCO 0301	PART	
107	1	COML	PANDUIT FCCS-A-D8	PART	
108	1	COML	FOAM TAPE 3/8 X 1/16 THK, 1REF 3M#4516 BLK)	PART	
109	1	COML	STAKE FASTENER, PS10F4CP5048G	PART	
110	3	H103102	8-32 X .375 HEX HEAD, SS	PART	
111	2	H103114	1/4-20 X .880 HEX HEAD, SS	PART	
112	4	H103400	***SEE TABLE ***10-24 X .375 TRIM HEX HEAD W/SIB-8	PART	
113	2	H110105	4-40 X .625 PAN HEAD PHIL, SS	PART	
114	5	H110114	8-32 X .312 PAN HEAD PHIL, SS	PART	
115	2	H110118	8-32 X .500 PAN HEAD PHIL, SS	PART	
116	2	H120400	B100580 SELF TAPPING-B BLK, OX., PAN HD PHIL	PART	
117	4	H120428	12-24 X 500 SELF TAPPING B, PAN HD PHIL,SS	PART	
118	4	H133320	5/16-18 X 1.000 HEX HEAD, SS	PART	
119	9	H183312	8-32 X .250-WHIZ LOCK, ZN	PART	
120	6	H183313	10-32 X .375 WHIZ LOCK, ZN	PART	

ITEM	QTY	PART NO	DESCRIPTION		
121	4	H183315	10-24 X .375 WHIZ LOCK, ZN	PART	
122	1	H183317	8-32 X .500 WHIZ LOCK, ZN	PART	
123	4	H183318	8-32 X .375-WHIZ LOCK, ZN	PART	
124	2	H235108	10-32X.19 LG SET SCREW	PART	
125	1	H302382	WHIZ LOCK NUT 8-32, ZN	PART	
126	1	H303024	5/16-24 HEX.NUT, SS	PART	
127	3	H401111	1/4" FLAT WASHER, SS	PART	
128	4	H401516	5/16" FLAT WASHER, SS	PART	
129	3	H402750	1/4" WASHER, TYPE B (.734 OD, .281 ID, .04 THK),SS	PART	
130	1	H414101	#6 INTERNAL LOCK WASHER, SS	PART	
131	1	H419102	5/16 LOCK WASHER SPLIT, SS	PART	
132	2	H424011	#4 INTERNAL LOCK WASHER, SS	PART	
133	4	H424103	#8 INTERNAL LOCK WASHER, SS	PART	
134	4	H425101	#8 EXTERNAL LOCK WASHER, SS	PART	
135	1	H509002	LATCH RELEASE CORD	PART	
136	1	H541108	ROLL PIN, 1/8 DIA. 5/8 LG SST	PART	
137	1	H555001	STAKE FASTENER, PS10F4CP5040G	PART	
138	4	H555002	STAKE FASTENER, S10F6CP5060BG	PART	
139	3	H732020	1/4X#25 SHOULDER SCREW, AL ST	PART	
140	4	H900053	4-163500 PLASTITE FLAT HEAD, PHIL HD	PART	
141	1	OP_MANUAL	***SEE TABLE ***OPERATORS MANUAL	PART	NOT SHOWN
142	3	P0023	***SEE TABLE ***SHIPMENT PACKAGING, ROTOR	PART	NOT SHOWN
143	1	P0043	ANTI-STATIC BAG 36X36	PART	NOT SHOWN
144	1	P0061	FRONT END PACK	PART	NOT SHOWN
145	1	P0062	BACK END PACK	PART	NOT SHOWN
146	1	P0063	***SEE TABLE ***CARTON	PART	NOT SHOWN
147	1	P0064	***SEE TABLE ***CARTON REFRIGERATED (INT)	PART	NOT SHOWN
148	2	P0161	COVER FOAM	PART	NOT SHOWN
149	1	P0207	***SEE TABLE ***FOAM PAD MMAX (INT)	PART	NOT SHOWN

TABULATION: MODEL vs. PART NO.

PART NO.	DESCRIPTION	PART NO.	3592	3592F	3593	3594	3596	6622	6623	6624	6628	6592	6593	6594
40346	LABEL, FUSE SLO/BLO 250V	40346	40346N	40346N	N	N	40346P	40346N	N	N	40346P	40346N	N	N
41170	LABEL, HIGH LEAKAGE	41170	41170	41170	N	N	N	41170	N	N	N	41170	N	N
43312	POWER CORD, INT'L	43312	N	N	43312	43312	N	N	43312	43312	N	N	43312	43312
43335	VOLTAGE SELECTOR LABEL	43335	N	N	N	N	43335	N	N	N	43335	N	N	N
44102	DATA PLATE FORMA	44102	N	N	N	N	N	N	44102F	44102G	44102H	N	44102D	44102P
44105	DATA PLATE-FORMA	44105	N	N	N	N	N	44105L	N	N	N	44105U	N	N
49856	ROTOR LID	49856	N	49856	N	N	N	N	N	N	N	N	N	N
49998	FUSE, TYPE T, 10A	49998	49998	49998	N	N	N	49998	N	N	N	4999B	N	N
50159	FUSE, 10.0A, 250V	50159	N	N	N	N	50159	N	N	N	50159	N	N	N
50537	POWER ENTRY MODULE	50537	N	N	50537C	50537C	N	N	50537C	50537C	N	N	50537C	50537C
50606	FUSE, 1/4 X 1 1/4	50606	50606A	50606A	N	N	N	50606A	N	N	N	50606A	N	N
50609	VOLTAGE SELECTOR SWITCH	50609	N	N	N	N	50609A	N	N	N	50609A	N	N	N
50611	LABEL, FUSE TYPE T, 250V	50611	N	N	50611B	50611B	N	N	50611B	50611B	N	N	50611B	50611B
50614	MEMBRANE PANEL	50614	50614B	50614B	50614B	50614B	50614B	50614D	50614D	50614D	50614D	50614F	50614F	50614F
50615	LOGIC BOARD ASSY (W/ PULSE)	50615	50615A	50615A	50615A	50615A	50615A	50615B	50615B	50615B	50615B	50615A	50615A	50615A
50619	FUSE DRAWER	50619	50619B	50619B	50619A	50619A	N	50619B	50619A	50619A	N	50619B	50619A	50619A
50627	FAN	50627	50627	50627	N	50627	N	50627	N	50627	N	50627	N	50627
50628	COMPRESSOR	50628	50628A	50628A	50628B	50628A	50628A	50628A	50628B	50628A	50628A	50628A	50628B	50628A
50638	TRANSFORMER, REFRIGERATED UNIT (230V)	50638	N	N	50638	N	N	N	50638	N	N	N	50638	N
50639	MAIN CABINET	50639	50639B	50639B	50639B	50639B	50639B	50639	50639	50639	50639	50639	50639	50639
50640	LID	50640	50640A	50640A	50640A	50640A	50640A	50640B	50640B	50640B	50640B	50640B	50640B	50640B
50727	FAN	50727	N	N	50727	N	50727	N	50727	N	50727	N	50727	N
50775	MOTOR MOUNTING PLATE	50775	50775	50775	50775	50775	50775	50775A	50775A	50775A	50775A	50775	50775	50775
53440	ROTOR 24 X 24 PLCS (1.5ML X 0.5ML)	53440	N	53440	N	N	N	N	N	N	N	N	N	N
56620	LABEL, FORMA MICROCENTRIFUGE (HP)	56620	N	N	N	N	N	56620A	56620A	56620A	56620A	56620B	56620B	56620B
61266	TRANSFORMER, 124V, 60 Hz	61266	N	N	N	61266	N	N	N	61266	N	N	N	61266
61268	TRANSFORMER, JAPANESE UNIT, 100V	61268	N	N	N	N	61268	N	N	N	61268	N	N	N
65358	POWER ENTRY MODULE	65358	65358	65358	N	N	65358	65358	N	N	65358	65358	N	N
65359	FUSE DRAWER	65359	N	N	N	N	65359	N	N	N	65359	N	N	N
65687	POWER CORD	65687	65687	65687	65687	65687	65687	65687	N	N	65687	65687	N	N
65691	MOTOR	65691	65691	65691	65691	65691	65691	N	N	N	N	65691	65691	65691
65720	MOTOR	65720	N	N	N	N	N	65720	65720	65720	65720	N	N	N
65726	MOTOR SHIELD	65726	N	N	N	N	N	65726	65726	65726	65726	N	N	N
66014	DATA LABEL W/ REFRIGERANT	66014	N	N	66014A	66014B	66014C	N	N	N	N	N	N	N
66016	DATA LABEL CSA-NRTL/C W/ REFRIGERANT	66016	66016A	66016A	N	N	N	N	N	N	N	N	N	N
H103400	10-24 X .375 TRIM HEX HEAD W/SIB-8	H103400	N	N	N	N	N	H103400	H103400	H103400	H103400	N	N	N
OP_MANUAL	OPERATORS MANUAL	OP_MANUAL	OM3590	OM3590	OM3590	OM3590	OM3590	OM5520	OM5520	OM5520	OM5520	OM5590	OM5590	OM5590
P0023	SHIPMENT PACKAGING, ROTOR	P0023	N	P0023	N	N	N	N	N	N	N	N	N	N
P0063	CARTON	P0063	P0063A	P0063A	N	N	N	P0063A	N	N	N	P0063A	N	N
P0064	CARTON REFRIGERATED (INT)	P0064	N	N	P0064	P0064	P0064	N	P0064	P0064	P0064	N	P0064	P0064
P0207	FOAM PAD MMAX (INT)	P0207	N	N	P0207	P0207	P0207	N	P0207	P0207	P0207	N	P0207	P0207

NOTES:
1. SET HEIGHT OF TEMPERATURE SENSOR (PART NO. 65692) BY ADJUSTING PROBE BODY FLUSH WITH GUARDBOWL ASSY BOTTOM PLATE.
2. APPLY LOCTITE 242 TO SHOULDER SCREW, MOTOR TRIMHEX HEAD & WHIZ LOCK SCREWS, SOLENOID NUT & HEX HEAD SCREWS FOR LATCH.
3. PERMANENTLY MARK "HOT" .625" HIGH, RED CHARACTERS CENTERED, ON TOP SURFACE OF RESISTOR (PART NO. 60430-A)
4. TIGHTEN SO THAT FLAT ON NUT IS PARALLEL TO FRONT OF LID LINER
5. GROUND PER IEC SPEC #35852.
6. INSTALL ACTIVE FUSES IN FUSE DRAWER; PACK SPARE FUSES WITH OPERATOR'S MANUAL (#3593,3594,5523,5524). IN FUSE DRAWER (#3592,3596,5522,5526,5527)
7. ASSEMBLE MOTOR BOOT WITH HIGH VACUUM GREASE BETWEEN MOTOR BOOT & GUARDBOWL.
8. ADD LUBRIPLATE AA TO INTERNAL LATCH ASSY.
9. ADHERE SILPAD (50534) TO HEAT SINK (63016) ADHERE INSULATION PAD (50633) TO CLAMP BAR (50620)
10. PRIOR TO WIRING COMPRESSOR, REMOVE COMPRESSOR CAP & TURN 180° SUCH THAT WIRES ARE AT OPPOSITE END OF CAP & SCRAPE GROUND LEAD MOUNTING SURFACE FOR CONTACT.
11. APPLY LOCTITE 242 TO SETSCREW THREADS BEFORE ASSEMBLY. USE AS LITTLE AS POSSIBLE TO AVOID GETTING LOCTITE ON MOTOR SHAFT OR OTHER ADAPTER SURFACES

MATERIAL:

FINISH:

UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN INCHES. DIMENSIONS ARE AFTER FINISH REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY √

ASSY. NO.	USED ON APPLICATION

	BY	DATE
DRAWN	ACREATE/MMTT_CPQ	
CHECKED		
APPROVED		

TOLERANCES: 2 PLACE DEC. ±.03 | 3 PLACE DEC. ±.005 | ANGLES ±1/2

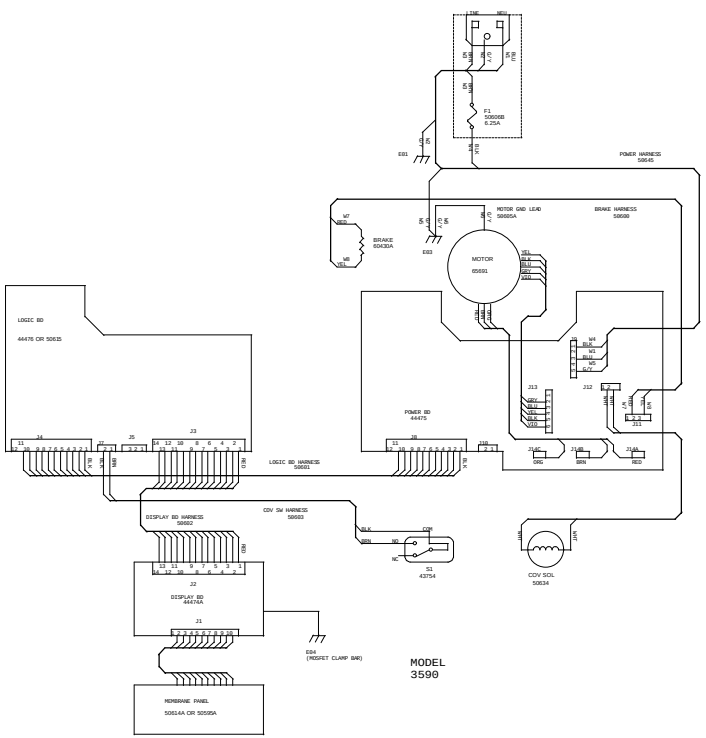
PARTS LIST. SEE PL:

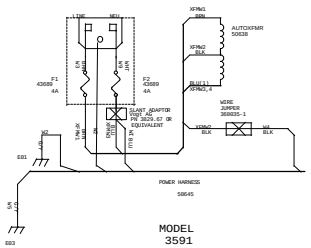
ThermoIEC

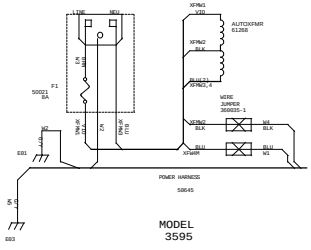
TITLE: MICROMAX, REFRIGERATED

SIZE	CODE ID NO.	DRAWING NO.	REV.
E		3592	17

SCALE- 1/2 SHEET 1 OF 2







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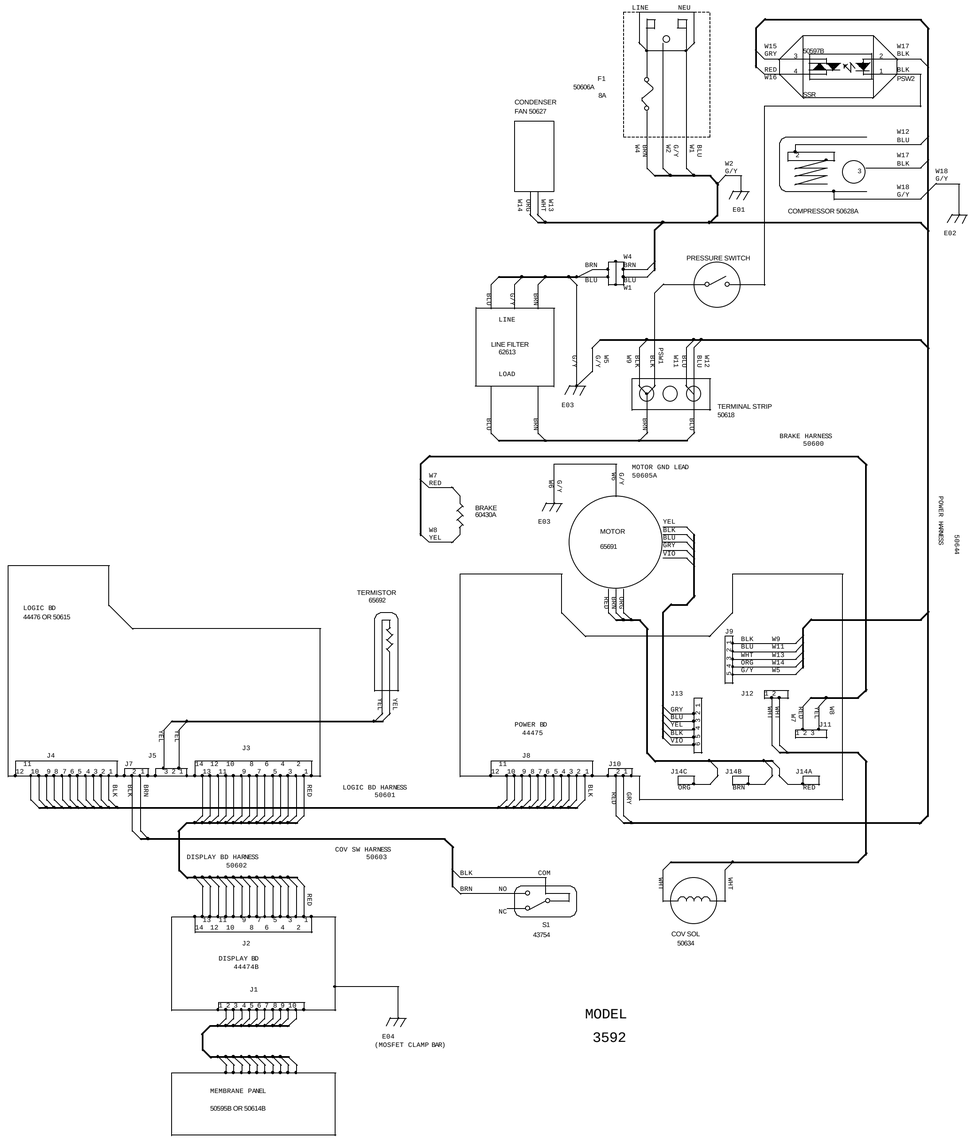
1	JAB	6/03/96	3553	JAB	6/03/96
2	JAB	8/19/96	3636	JAB	8/19/96
3	JAB	10/24/96	3724	JAB	10/24/96
4	SEL	3/24/98	4440	DAM	3/26/98
5	DWM	03/24/99	4853	DWM	03/24/99

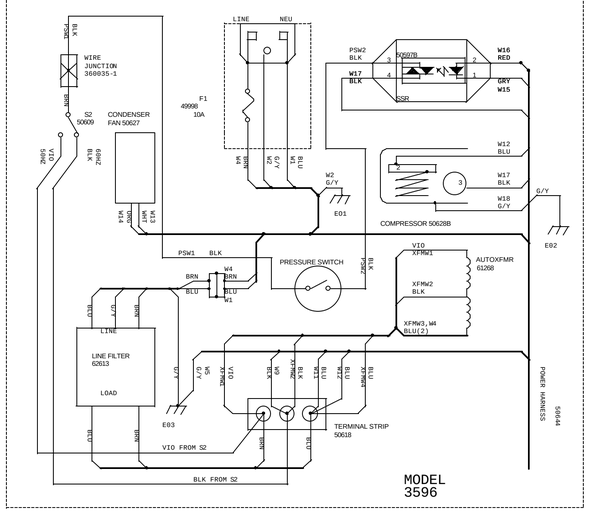
INTERNATIONAL EQUIPMENT COMPANY
300 SECOND AVE
NEEDHAM HGHTS, MA. 02194

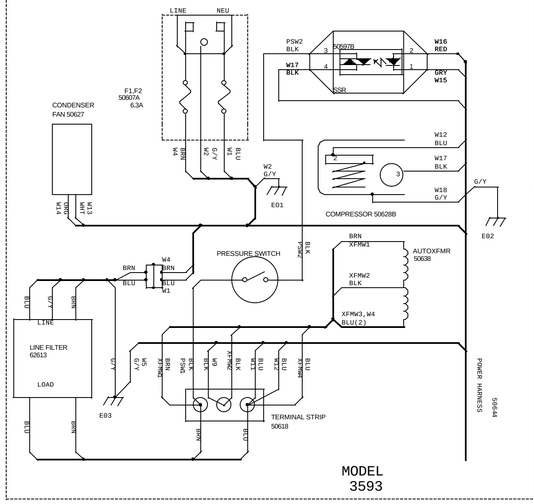
Title: SYSTEM SCHEMATIC, VENTILATED MICROMAX

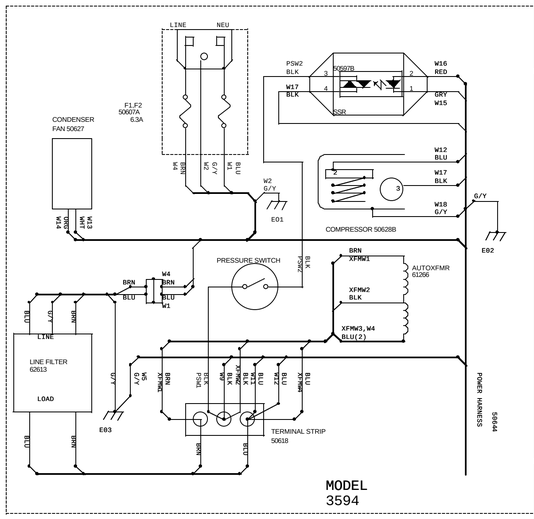
Size	Document Number	Rev
D	130778	5

Date: Monday, November 08, 1999 Sheet 1 of 1









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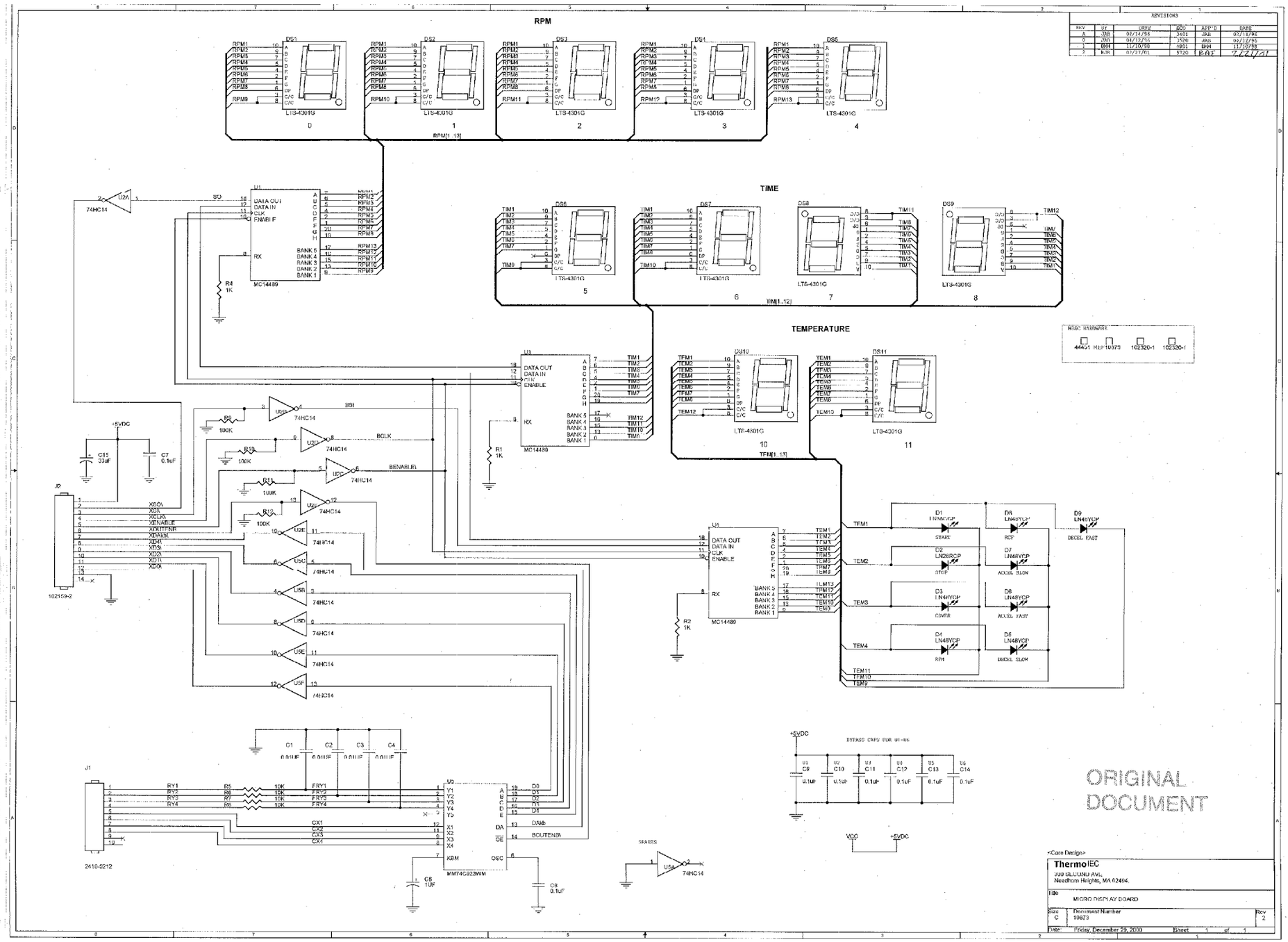
1	JAB	6/03/96	3553	JAB	6/03/96
2	JAB	8/12/96	3636	JAB	8/12/96
3	JAB	10/16/96	3724	JAB	10/16/96
4	SEL	3-14-98	4440	DM	3-16-98

INTERNATIONAL EQUIPMENT COMPANY
300 SECOND AVE
NEEDHAM HGHTS, MA. 02194

Title: SYSTEM SCHEMATIC, REFRIGERATED MICROMAX

Size: D | Document Number: 10872 | Rev: 4

Date: Wednesday, February 28, 2001 | Sheet 1 of 1


RPM
TIME
TEMPERATURE
REVISIONS
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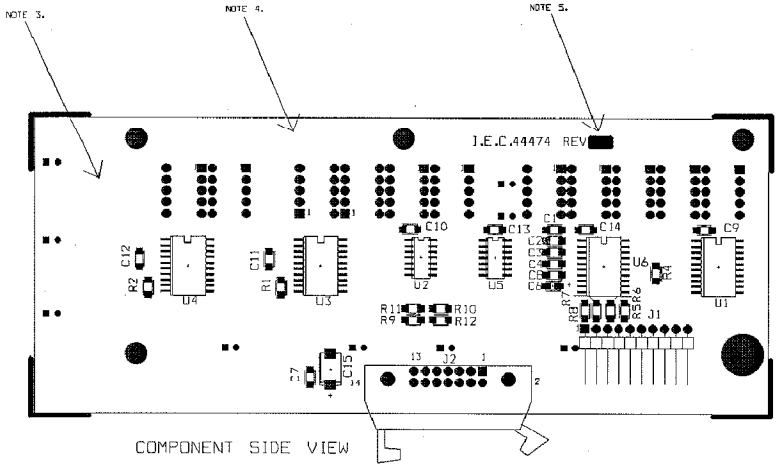
MC14489
74HC14
MM74C923WM
LTS-4301G
DATA OUT
DATA IN
CLK
ENABLE
RX
BANK 5
BANK 4
BANK 3
BANK 2
BANK 1
+5VDC
BYPASS CAPS FOR U1-U6
ORIGINAL DOCUMENT
ThermoIEC
300 SUDBURY AVE.
Needham Heights, MA 02494.
MICRO DISPLAY BOARD
Document Number
10979
Rev
2
Friday, December 29, 2000

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
A	--	JB	02/14/96	3401	JB	02/14/96
0	--	JB	04/12/96	3520	JB	04/12/96
1	--	JB	01/03/97	3724	JB	01/03/97
2	--	DNM	11/09/98	4801	DNM	11/09/98
3	--	MJR	02/22/01	5720	RAF	2/27/01



COMPONENT SIDE VIEW

NOTES:

1. SQUARE PADS INDICATE THE FOLLOWING:
   A. PIN "1" OF MULTILEAD DEVICES.(DIPS, SIPS, POTS, ETC.)
   B. POLARITY PINS OF DISCRETE COMPONENTS.
      (CATHODE, EMITTER, "+", ETC.)
2. DS1-DS11 AND D1-D7 MOUNTED ON OPPOSITE SIDE OF P.C. BOARD AFTER OTHER COMPONENTS HAVE BEEN ASSEMBLED.
3. PLACE VENDOR I.D. HERE
4. PLACE VENDOR SERIAL NUMBER HERE
5. MARK BOARD ASSEMBLY REVISION NUMBER HERE

ORIGINAL DOCUMENT

REF: SCHEMATIC NO. C10873

DRAWN	ZENITH	3/15/96
ENGINEER		
ELECTRICAL ENGINEER	JAB	04/12/96
MECHANICAL ENGINEER		
SAFETY ASSURANCE		
MANUFACTURING ENGINEER		
PROJECT APPROVAL		

UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS & BREAK SHARP EDGES .005 MAX.
DIMENSIONS ARE IN INCHES TOLERANCE
DECIMALS ± .XX ± .005 ± .XXX ± .002 FRACTIONS ± 1/32 ANGLES ± 1°
SURFACE ROUGHNESS
DO NOT SCALE PRINT

INTERNATIONAL EQUIPMENT CO.

ASSEMBLY DRAWING
DISPLAY RMICRO

SIZE	EDAC IDENT NO.	TYPE		REV
B			44474	3

SCALE 1/1 SHEET 1 OF 2

Part Number: 44477B
Revision Level: 7

Part Number	Description		Part Reference	Qty
UCN0003-01	Microcontroller		U13	1
	Motorola	MC68HCP11E0FN		
TPT0000-00	TEST POINT, SOLDER TERMINAL, TURRET, 0.063"		TP1 TP2 TP3 TP4 TP5	5
	Mill-max	2108-2-00-44-00-00-07-0		
SPC0006-00	PAD		For X1 MNT1	1
	BIVAR	CI-192-028		
SOC0002-00	SOCKET,IC,28 PIN DIP,.6 C-C		For U10	1
	CIRCUIT ASSY	CA-28MSC-1F		
SOC0001-00	SOCKET,IC,24 PIN DIP,.6 C-C		For U12	1
	CIRCUIT ASSY	CA-24MSC-1F		
RES0171-01	RES, MF, 4.7K, 1/8W, 5%, SM		R1 R5 R9 R11 R12 R13 R66	7
	Dale	CRCW1206472JRT1		
RES0162-01	RES, MF, 20K,1/8W, 5%, SM		R22	1
	Dale	CRCW1206203JRT1		
RES0161-01	RES 390		R19 R21	2
	Dale	CRCW1206391JRT1		
RES0138-01	RES 680R		R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49	11
	Dale	CRCW1206681JRT1		
RES0089-01	RES 330K		R17 R18	2
	Dale	CRCW1206334JRT1		
RES0082-01	RES 3.32K, 1%		R3	1
	Dale	CRCW12063321FRT1		
RES0063-01	RES 2.87k, 1%		R7	1
	Dale	CRCW12062871FRT1		
RES0054-01	RES, MF, 1M,1/8W, 5%, SM		R16 R57 R58 R59	4
	Dale	CRCW1206105JRT1		

Part Number: 44477B
Revision Level: 7

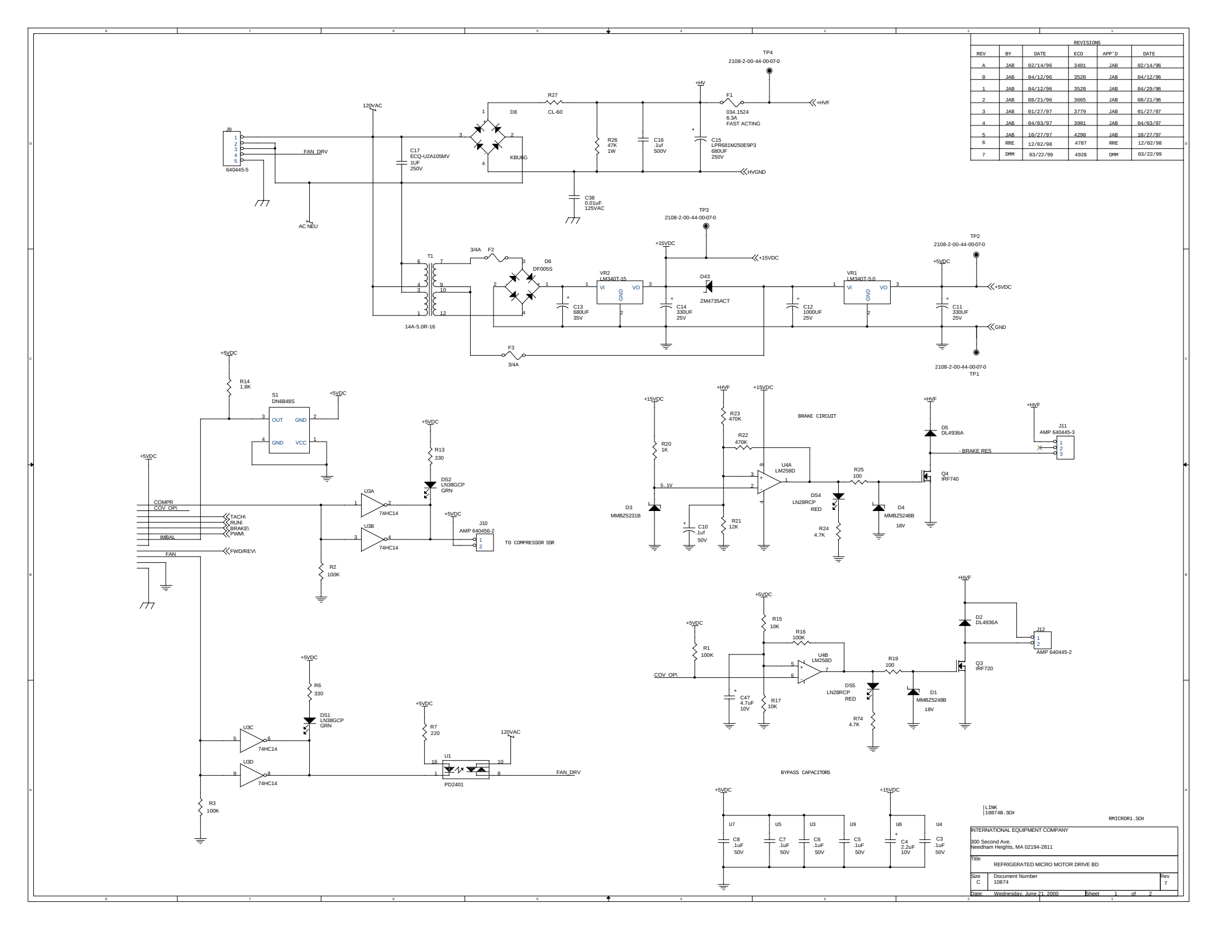
Part Number	Description		Part Reference	Qty
RES0050-01	RES, MF, 1K,1/8W, 1%, SM		R10 R30 R31 R32 R61	5
	Dale	CRCW12061001FRT1		
RES0028-01	RES 10M		R14	1
	Dale	CRCW1206106JRT1		
RES0022-01	RES, MF, 10K, 1/8W, 5%, SM		R15 R33 R34 R35 R36 R37 R38	7
	Dale	CRCW1206103JRT1		
RES0017-01	RES, MF, 100K,1/8W, 5%, SM		R2 R4 R23 R24 R25 R26 R27 R28 R29 R50 R51 R52 R53 R54	20
	Dale	CRCW1206104JRT1	R55 R56 R62 R63 R64 R65	
RES0011-01	RES, MF, 100R, 1/8W, 5%, SM		R20	1
	Dale	CRCW1206101JRT1		
RES0005-01	RES 1.1K		R6 R8	2
	Dale	CRCW12061101FRT1		
REF35463	TEST PROCEDURE PC BD		REF2	1
REF10879	SCHEMATIC,PC BD		REF1	1
OPT0014-00	IC,OPTO-ISOL		U6 U7 U9	3
	GE	H11A1		
LED0027-00	DISPLAY, 7 SEG		DS1 DS2 DS3 DS4 DS5 DS6 DS7 DS8 DS9 DS10 DS11 DS12	14
	Lite-On	LTS-4301G	DS13 DS14	
ICD0065-00	EPROM,IEC P/N 51425		U10	1
	National	NM27C256Q120		
ICD0050-01	IC,CMOS,QUAD,2 INPUT OR		U2 U22	2
	Motorola	MC74HC32D		
ICD0049-01	IC,CMOS,3 TO 8 DECODER		U5	1
	Motorola	MC74HC138D		

Part Number: 44477B
Revision Level: 7

Part Number	Description		Part Reference	Qty
ICD0048-01	IC,CMOS,HEX D FLIP-FLOP W/COMMON CLOCK		U19 U20 U21	3
	Motorola	MC74HC174D		
ICD0045-01	IC,CMOS,OCTAL,3-STATE		U11	1
	Motorola	MC74HC374ADW		
ICD0015-01	IC,CMOS,HEX,SCHMITT INV, 74HC14, SOIC		U1 U3 U4 U15	4
	Motorola	MC74HC14D		
ICD0013-00	IC,RAM,CMOS,NON-VOL,2KX8		U12	1
	Dallas	DS1220AD-200		
ICD0007-01	IC,CMOS,OCTAL,3-STATE		U14	1
	Motorola	MC74HC373ADW		
ICA0010-01	IC,U/V SENSE, 5V, MC34064, SO-8		U8	1
	Motorola	MC33064D-5		
ICA0007-01	DISPLAY DRIVERS		U16 U17 U18	3
	Motorola	MC14489ADW		
DIO0005-01	DIODE,SIGNAL		D1 D2 D3 D4 D5 D6	6
	Vishay/Lite-On	MMBD4148		
CRY0000-00	CRYSTAL 8.000MHz		X1	1
	ECS Int'l Inc.	ECS-80-32-4		
CON0069-00	CONNECTOR, 12 PIN		J1 J2	2
	3M	2412-5212		
CON0067-00	HEADER, 14 PIN		J3	1
	Amp	1-640456-4		
CON0063-00	CONNECTOR		J4	1
	Molex	52018-6615		
CON0027-00	HEADER, 3 PIN		J6	1
	Amp	640456-3		

Part Number: 44477B
Revision Level: 7

Part Number	Description		Part Reference	Qty
CON0006-00	HEADER,2 PIN, FRICTION LOCK, 0.100" PITCH		J5	1
	Amp	640456-2		
CAP0209-00	Cap 2200pF, 50V		C39	1
	Kemet	C1206C222K5GAC		
CAP0148-00	CAP 2.2UF,10V		C17 C20 C23 C28 C31 C33	6
	Panasonic	ECS-T1AY225R		
CAP0146-00	CAP 22UF,10V		C12	1
	Panasonic	ECS-T1AC226R		
CAP0145-00	CAP 150UF,10V		C13	1
	AVX	TPSD157K010R01M		
CAP0128-00	CAP 1uf,16V		C5 C18	2
	Panasonic	ECS-H1CY105R		
CAP0127-00	CAP 0.01uf, 50V, 10%, Z5U, SM		C38	1
	Kemet	C1206C103K5UAC		
CAP0110-00	CAP 1000pF,50V		C10 C34 C35 C36 C37	5
	Kemet	C1206C102K5GAC		
CAP0106-00	CAP, X7R, 0.1uF, 50V, 10%, SM		C1 C2 C3 C4 C6 C7 C11 C14 C15 C16 C19 C21 C22 C24 C25	20
	Kemet	C1206C104K5RAC	C26 C27 C29 C30 C32	
CAP0062-00	CAP MONO CER,22pF,50V		C8 C9	2
	Kemet	C1206C220K5GAC		
BPR0000-00	Beeper, Piezo, PC MNT		B1	1
	Projects Unlimited	AI-550KS		
44457	ARTWORK,PC BD		PCB1	1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0 JAB 04/12/96 3520 JAB 04/12/96
1 JAB 04/12/96 3520 JAB 04/29/96
2 JAB 08/21/96 3665 JAB 08/21/96
3 JAB 01/27/97 3779 JAB 01/27/97
4 JAB 04/03/97 3901 JAB 04/03/97
5 JAB 10/27/97 4298 JAB 10/27/97
6 RRE 12/02/98 4787 RRE 12/02/98
7 DMM 03/22/99 4928 DMM 03/22/99
TP4
2108-2-00-44-00-07-0
+HV
F1
034.1524
6.3A
FAST ACTING
+HVF
R27
CL-60
120VAC
D8
KBU6G
J9
640445-5
FAN_DRV
C17
ECQ-U2A105MV
1UF
250V
R26
47K
1W
C16
.1uf
500V
C15
LPR681M250E9P3
680UF
250V
HVGND
C38
0.01uF
125VAC
AC NEU
TP3
2108-2-00-44-00-07-0
+15VDC
T1
14A-5.0R-16
3/4A F2
D6
DF005S
VR2
LM340T-15
VI GND VO
D43
ZM4735ACT
C13
680UF
35V
C14
330UF
25V
C12
1000UF
25V
VR1
LM340T-5.0
C11
330UF
25V
TP2
2108-2-00-44-00-07-0
+5VDC
GND
F3
3/4A
TP1
2108-2-00-44-00-07-0
R14
1.8K
S1
DN6848S
OUT GND VCC
R13
330
DS2
LN38GCP
GRN
COMPR
COV_OP\
TACH\
RUN\
BRAKE\
PWM\
IMBAL
FWD/REV\
FAN
U3A
74HC14
U3B
74HC14
J10
AMP 640456-2
TO COMPRESSOR SSR
R2
100K
BRAKE CIRCUIT
R20
1K
5.1V
D3
MMBZ5231B
R23
470K
R22
470K
U4A
LM258D
R25
100
Q4
IRF740
D5
DL4936A
- BRAKE RES
J11
AMP 640445-3
DS4
LN28RCP
RED
D4
MMBZ5248B
18V
C10
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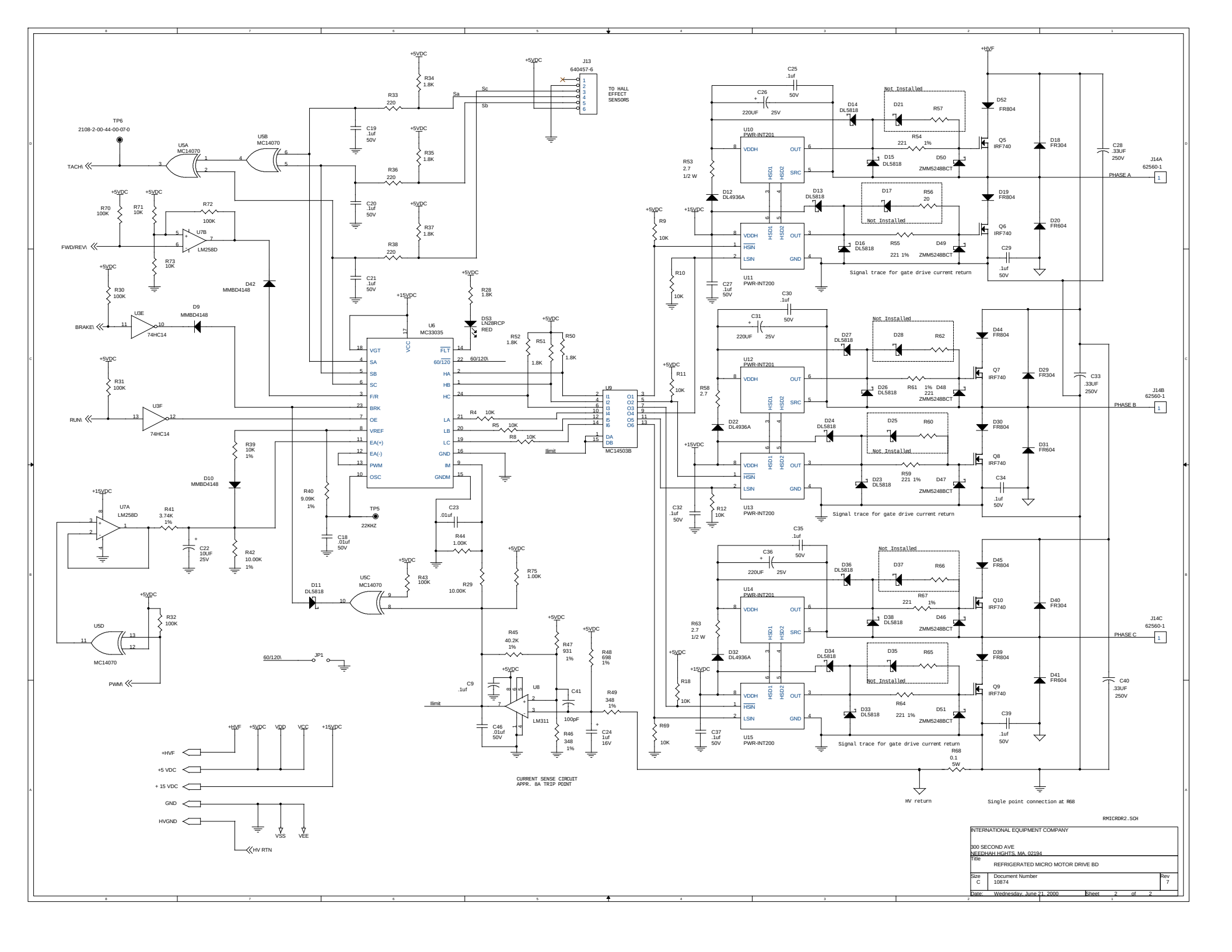
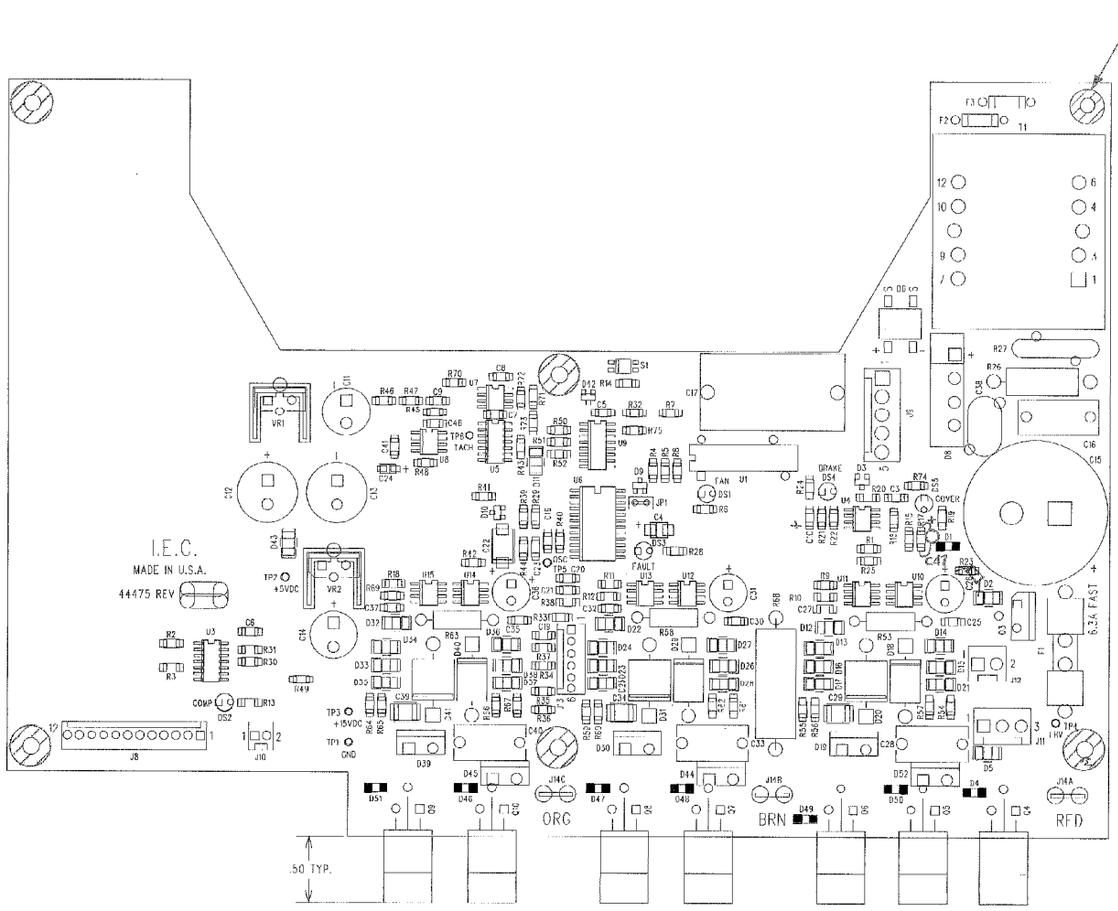
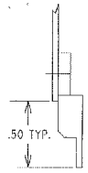
50V
R21
12K
R24
4.7K
R6
330
DS1
LN38GCP
GRN
U3C
74HC14
U3D
74HC14
R3
100K
R7
220
U1
PD2401
120VAC
FAN_DRV
R15
10K
R16
100K
R1
100K
U4B
LM258D
R19
100
Q3
IRF720
D2
DL4936A
J12
AMP 640445-2
DS5
LN28RCP
RED
D1
MMBZ5248B
18V
C47
4.7uF
10V
R17
10K
R74
4.7K
BYPASS CAPACITORS
U7 C8 .1uF 50V
U5 C7 .1uF 50V
U3 C6 .1uF 50V
U9 C5 .1uF 50V
U6 C4 2.2uF 10V
U4 C3 .1uF 50V
LINK
10874B.SCH
RMICRDR1.SCH
INTERNATIONAL EQUIPMENT COMPANY
300 Second Ave.
Needham Heights, MA 02194-2811
Title
REFRIGERATED MICRO MOTOR DRIVE BD
Size C
Document Number 10874
Rev 7
Date: Wednesday, June 21, 2000
Sheet 1 of 2


TP6
2108-2-00-44-00-07-0
TACH\
U5A
MC14070
U5B
MC14070
+5VDC
R34
1.8K
R33
220
Sa
Sc
Sb
J13
640457-6
TO HALL
EFFECT
SENSORS
C19
.1uf
50V
R35
1.8K
R36
220
C20
.1uf
50V
R37
1.8K
R38
220
C21
.1uf
50V
+15VDC
U6
MC33035
VCC
VGT
SA
SB
SC
F/R
BRK
OE
VREF
EA(+)
EA(-)
PWM
OSC
FLT
60/120\
HA
HB
HC
LA
LB
LC
GND
IM
GNDM
DS3
LN28RCP
RED
R28
1.8K
R52
1.8K
R51
1.8K
R50
1.8K
U9
MC14503B
DA
DB
R4
10K
R5
10K
R8
10K
Ilimit
FWD/REV\
R70
100K
R71
10K
R72
100K
U7B
LM258D
R73
10K
D42
MMBD4148
BRAKE\
U3E
74HC14
D9
MMBD4148
R30
100K
RUN\
U3F
74HC14
R31
100K
D10
MMBD4148
R39
10K
1%
U7A
LM258D
R41
3.74K
1%
C22
10UF
25V
R42
10.00K
1%
R40
9.09K
1%
C18
.01uf
50V
TP5
22KHZ
C23
.01uf
R44
1.00K
R29
10.00K
R75
1.00K
D11
DL5818
U5C
MC14070
R43
100K
U5D
MC14070
R32
100K
PWM\
60/120\
JP1
R45
40.2K
1%
R47
931
1%
R48
698
1%
C9
.1uf
U8
LM311
C41
100pF
R49
348
1%
R46
348
1%
C46
.01uf
50V
C24
1uf
16V
CURRENT SENSE CIRCUIT
APPR. 8A TRIP POINT
+HVF
+5 VDC
+ 15 VDC
GND
HVGND
VDD
VCC
VSS
VEE
HV RTN
C25
.1uf
50V
C26
220UF
25V
D14
DL5818
Not Installed
D21
R57
U10
PWR-INT201
VDDH
OUT
HSD1
HSD2
SRC
HSIN
LSIN
GND
R54
221
1%
D15
DL5818
D50
ZMM5248BCT
R53
2.7
1/2 W
D12
DL4936A
D13
DL5818
D17
R56
20
Not Installed
R55
221 1%
D16
DL5818
D49
ZMM5248BCT
U11
PWR-INT200
Signal trace for gate drive current return
C27
.1uf
50V
R9
10K
R10
10K
C30
.1uf
50V
C31
220UF
25V
D27
DL5818
D28
R62
U12
PWR-INT201
D26
DL5818
R61
1%
D48
221
ZMM5248BCT
R58
2.7
D22
DL4936A
D24
DL5818
D25
R60
Not Installed
D23
DL5818
R59
221 1%
D47
ZMM5248BCT
U13
PWR-INT200
Signal trace for gate drive current return
C32
.1uf
50V
R11
10K
R12
10K
C35
.1uf
50V
C36
220UF
25V
D36
DL5818
D37
R66
Not Installed
U14
PWR-INT201
R67
221
1%
D38
DL5818
D46
ZMM5248BCT
R63
2.7
1/2 W
D32
DL4936A
D34
DL5818
D35
R65
Not Installed
R64
221 1%
D33
DL5818
D51
ZMM5248BCT
U15
PWR-INT200
Signal trace for gate drive current return
C37
.1uf
50V
R18
10K
R69
10K
R68
0.1
5W
HV return
Single point connection at R68
+HVF
D52
FR804
Q5
IRF740
D18
FR304
C28
.33UF
250V
J14A
62560-1
PHASE A
D19
FR804
Q6
IRF740
D20
FR604
C29
.1uf
50V
D44
FR804
Q7
IRF740
D29
FR304
C33
.33UF
250V
J14B
62560-1
PHASE B
D30
FR804
Q8
IRF740
D31
FR604
C34
.1uf
50V
D45
FR804
Q10
IRF740
D40
FR304
J14C
62560-1
PHASE C
D39
FR804
Q9
IRF740
D41
FR604
C40
.33UF
250V
C39
.1uf
50V
RMICRDR2.SCH
INTERNATIONAL EQUIPMENT COMPANY
300 SECOND AVE
NEEDHAH HGHTS, MA. 02194
Title
REFRIGERATED MICRO MOTOR DRIVE BD
Size
C
Document Number
10874
Rev
7
Date:
Wednesday, June 21, 2000
Sheet
2
of
2

REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
0	---	JAB	05/02/96	3520	JAB	05/02/96
1	---	JAB	05/02/96	3520	JAB	05/02/96
2	---	JAB	06/25/96	3553	JAB	06/25/96
3	---	JAB	08/21/96	3665	JAB	08/21/96
4	---	JAB	01/27/97	3779	JAB	01/27/97
5	---	JAB	01/27/97	3779	JAB	01/27/97
6	---	JAB	01/27/97	3779	JAB	01/27/97
7	---	JAB	01/27/97	3779	JAB	01/27/97
8	---	JAB	04/04/97	3901	JAB	04/04/97
9	---	JAB	10/28/97	4290	JAB/DMM	11/03/97
10	---	JAB	10/28/97	4290	JAB/DMM	11/03/97
11	---	DMM	1/20/98	4344	DMM	1/20/98
12	-	PL	4/24/98	4787	LEZ	04/24/98
13	-	DMM	04/05/99	4928	DMM	04/05/99
14	-	MD	9/21/99	5099	MD	12-14-99



AS VIEWED FROM COMPONENT SIDE



Q4-Q10 TYP. (BOTTOM SOLDER SIDE)

NOTES:

1. SQUARE PADS INDICATE THE FOLLOWING:
   A. PIN "1" OF MULTILEAD DEVICES.(DIPS, SIPS, POTS, ETC.)
   B. POLARITY PINS OF DISCRETE COMPONENTS. (CATHODE, EMITTER, "+", ETC.)
2. Q4-Q10 MOUNTED ON OPPOSITE SIDE OF P.C. BOARD.
3. C47 INSTALLED ACROSS R17(+) AND COMMON WITH R17/R15 NODE,(-) AT CIRCUIT GND
4. D17, D21, D25, D28, D35, D37 R56, R57, R61, R62, R59, R60, R66, R67 ARE NOT INSTALLED
5. APPLY CONFORMAL COATING TO ENTIRE ASSEMBLY EXCEPT WHERE INDICATED ON THE BILL OF MATERIALS. AND IN HATCHED AREA INDICATED ON THIS PRINT MINIMUM COATING THICKNESS OF 0.003" MUST BE MAINTAINED. REMOVE COATING FROM INNER SURFACE OF MOUNTING HOLES.

ORIGINAL DOCUMENT

SCHEMATIC REF. NO. C10874

DRAWN	ZENITH	10/28/97	INTERNATIONAL EQUIPMENT CO.
CHECKED			
ELECTRICAL ENGINEER			ASSEMBLY DRAWING
MECHANICAL ENGINEER			REF. MICROMAX MOTOR DRIVE
QUALITY ASSURANCE			
PROJECT MANAGER			
PROJECT APPROVAL			SIZE C · CODE IDENT NO. · TYPE · 44475 · REV 14

UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS & BREAK SHARP EDGES .005 MAX.
DIMENSIONS ARE IN INCHES TOLERANCE ON
DECIMALS .XX +/-.05, .XXX +/-.005
FRACTIONS +/- 1/32
ANGLES +/- 1°
SURFACE ROUGHNESS
DO NOT SCALE PRINT

SCALE 2/1 · SHEET 1 OF 1

Tel.: +(781)449-8060 Fax: +(781)455-9749

REFRIGERATED MICROMAX MOTOR DRIVE BD

ASSY PN 44475 REV 14

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
1	15	C3,C5,C6,C7,C8,C9 C19,C20,C21, C25,C27,C30,C32, C35,C37	Capacitor .1UF@50VDC Panasonic ECU-V1H104KBM	SMT 1206	YES
2	1	C16	Capacitor .1UF@400VDC Panasonic ECQ-E4104KF SPRAGUE 5GP10	Thru-Hole PE.10	YES
3	3	C18,C23,C46	Capacitor .01uF@50VDC Panasonic ECU-V1H103KBM	SMT 1206	YES
4	1	C15	Capacitor 680UF@250VDC AreoM LPR681M250E9P3	Thru-Hole AMLRP	YES
5	1	C13	Capacitor 680UF@35VDC ILLINOIS CAP 687CKR035M	Thru-Hole	YES
6	2	C11,C14	Capacitor 330UF@25VDC NICHICON UVX1E331MPA	Thru-Hole	YES
7	1	C22	Capacitor 10UF@25VDC Panasonic ECS-H1ED106R	SMT SIZE D	YES
8	3	C26,C31,C36	Capacitor 220UF@25V NICHICON UVX1E221MPA	Thru-Hole	YES
9	3	C28,C33,C40	Capacitor .33UF@250VDC NICHICON QXJ2E334KTPT NIC NRM334K250	Thru-Hole	YES

REFRIGERATED MICROMAX MOTOR DRIVE BD

ASSY PN 44475 REV 14

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
10	1	C38	Capacitor 0.01UF@125VAC Panasonic ECK-DRS103ME	Thru-Hole PM.0033	YES
11	2	DS1,DS2	Diffused Solid State Green PANASONIC LN38GCP	Thru-Hole LED	YES
12	3	DS3,DS4,DS5	Diffused Solid State PANASONIC LN28RCP	Thru-Hole LED	YES
13	8	D1,D4,D46,D47,D48, D49,D50,D51	Zener 18V, 1/2 Watt Motorala ZMM5248BCT DIODES INC ZMM5248BT	SMT **DL-35**	YES
14	1	D3	Zener 5.1V, 1/2 Watt Motorala MMBZ5231B	SMT **SOT-23**	YES
15	5	D2,D5,D12,D22,D32	Rectifier, Fast Recovery 400V, 1A Motorola DL4936A	SMT **DL-41**	YES
16	1	D6	Bridge Rectifier 50V, 1A Diodes Inc DF005S	SMT SMBR4	YES
17	1	D8	Bridge Rectifier DIODES INC KBU6G	Thru-Hole BR4\UP	YES
18	2	D9,D10	Diode Motorala MMBD4148	SMT **SOT-23**	YES
19	13	D11,D13,D14,D15,D16, D33,D34, D36, D38	Rectifier D23,D24, D26,D27, DL5818	SMT Schottky Barrier	YES **DL-41**

REFRIGERATED MICROMAX MOTOR DRIVE BD

ASSY PN 44475 REV 14

ITEM	QTY	REFERENCE	PART/	PKG	CONFORMAL
20	3	D18,D29,D40	400V, 3A Diodes Inc. FR304	- D027	YES
			, 8A Diodes Inc. FR804	- T0220 2	NO
22	3	D20,D31,D41	Rectifier, Fast Recovery	Thru Hole	
23	2	FH1,FH2	Fuse Holder	Thru Hole	
			Signal Wire Un insulated	-	YES
25	1		AMP, MTA.100 1 640456 2	- **HD.100 12U**	NO
26	1	J9	Connector -	Thru Hole -	
			AMP, MTA.100 640456 6	- HD.100 6U	NO
28	1	J12	Connector -	Thru Hole -	
			AMP, MTA.156 640445 3	- HD.156 3U	NO
30	3		PCB, 250 TAB -	- HD.250 1U	NO

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
31	7	Q4,Q5,Q6,Q7,Q8,Q9,Q10	FET 400V, 10 A International Rectifier IRF740	Thru-Hole TO-220AB	NO
32	1	Q3	FET 400V, 3.3 A International Rectifier IRF720	Thru-Hole TO-220AB	YES
33	10	R1,R2,R3, R16, R30,R31,R32,R43, R70,R72	Resistor 100KΩ, 5% Dale CRCW1206104JRT1	SMT 1206	YES
34	2	R6,R13	Resistor 330Ω, 5% Dale CRCW1206331JRT1	SMT 1206	YES
35	4	R7,R33,R36,R38	Resistor 220Ω, 5% Dale CRCW1206221JRT1	SMT 1206	YES
36	2	R19,R25	Resistor 100Ω, 5% Dale CRCW1206101JRT1	SMT 1206	YES
37	3	R20,R44,R75	Resistor 1KΩ, 1% Dale CRCW12061001FRT1	SMT 1206	YES
38	2	R24,R74	Resistor 4.7KΩ, 5% Dale CRCW1206472JRT1	SMT 1206	YES
39	8	R14,R28,R34,R35,R37,R50, R51,R52	Resistor 1.8KΩ, 5% Dale CRCW1206182JRT1	SMT 1206	YES

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
40	16	R4,R5,R8, R15,R17, R29,R39,R42,R71,R73 R9-R12,R18,R69	Resistor 10KΩ, 1% Dale CRCW12061020FRT1	SMT 1206	YES
41	1	R21	Resistor 12KΩ, 5% Dale CRCW1206123JRT1	SMT 1206	YES
42	1	R22	Resistor 470KΩ, 5% Dale CRCW1206474JRT1	SMT 1206	YES
43	1	R26	Resistor, 1 Watt 47KΩ, 5%	Thru-Hole R1W	YES
44	1	R27	Inrush Current KEYSTONE Limiter CL-60	Thru-Hole	YES
45	1	R40	Resistor 9.09KΩ, 1% Dale CRCW12069091FRT1	SMT 1206	YES
46	1	R41	Resistor 3.74KΩ, 1% Dale CRCW12063741FRT1	SMT 1206	YES
47	1	R48	Resistor 698Ω, 1% Dale CRCW12066980FRT1	SMT 1206	YES
48	1	R45	Resistor 40.2KΩ, 1% Dale CRCW12064022FRT1	SMT 1206	YES
49					
50	2	R46,R49	Resistor 348Ω, 1% Dale	SMT 1206	YES

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
			CRCW12063480FRT1		
51	3	R53,R58,R63	Resistor, 1/2 Watt 2.7Ω, 5% Phillips 5053CX2R700J	Thru-Hole R1/2W	YES
52	6	R54,R55,R59,R61,R64,R67	Resistor 221Ω, 1% Dale CRCW12062210FRT1	SMT 1206	YES
53					
54	1	R68	Resistor, 5 Watt .1Ω, 1% Memcor-Truohm SL5-0.1 DALE LVR-5.0-0.1Ω	Thru-hole R5W	YES
55	6	TP1,TP2,TP3,TP4,TP5,TP6	Test Point MILLMAX 2108-2-00-44-00-07-0	Thru-Hole	YES
56	1	T1	Transformer Signal 14A-5.0R-16	Thru-Hole TRAN1-16	YES
57	2	U4,U7	Op-Amp Motorala LM258D	SMT DIP8\SO	YES
58	1	U3	Inverter Schmitt Trigger Motorala MC74HC14D	SMT DIP14\SO	YES
59	1	U6	DC Brushless Motor Controller Motorala MC33035DW	SMT DIP24\SOL	YES
60	1	U5	Exclusive OR Motorala MC14070BD	SMT DIP14\SO	YES

REFRIGERATED MICROMAX MOTOR DRIVE BD

ASSY PN 44475 REV 14

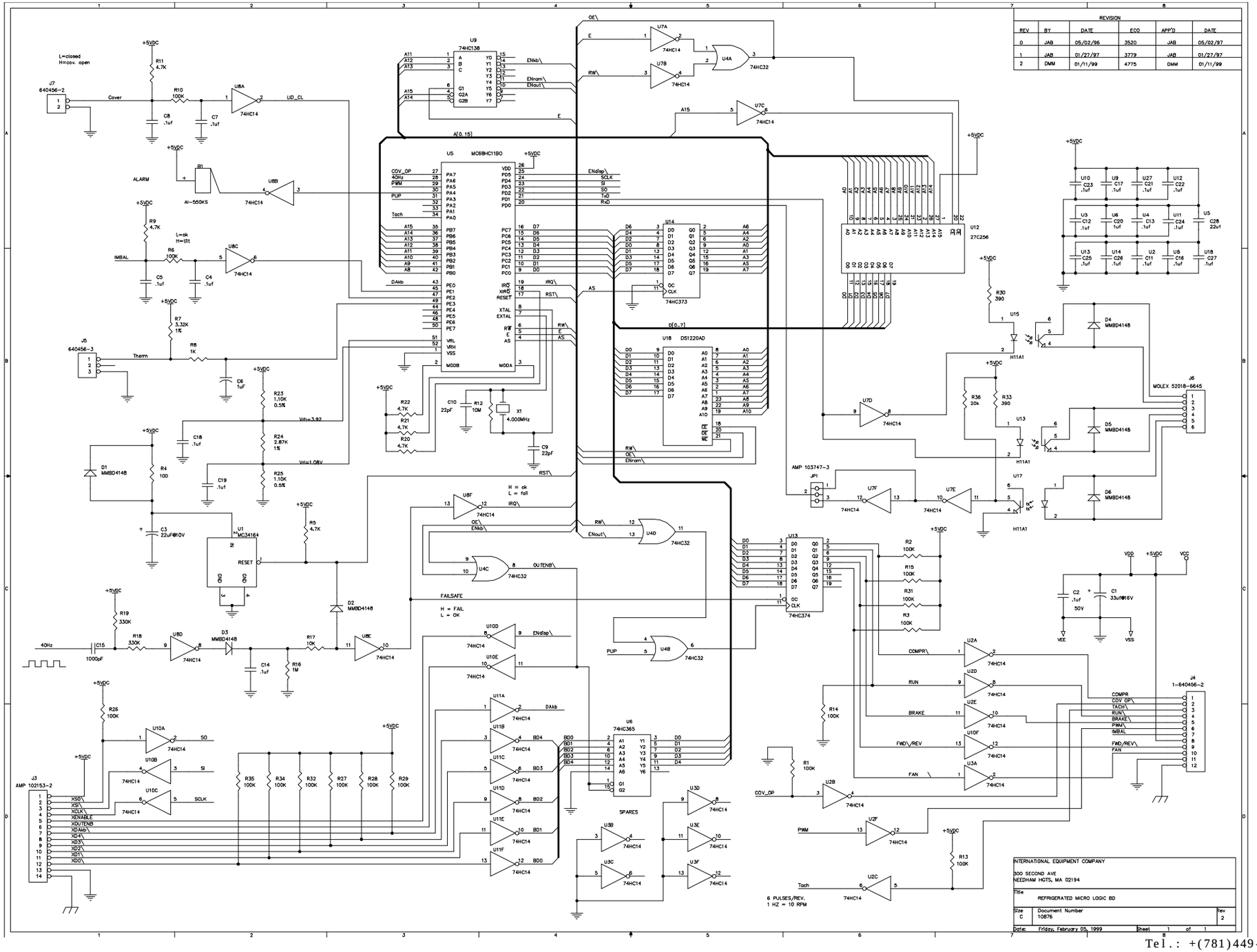
ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
61	1	U9	TRISTATE HEX INVERTER Motorala MC14503D	SMT DIP16\SO	YES
62	3	U10,U12,U14	Mosfet Driver POWER INT PWR-INT201TFI	SMT DIP8\SO	YES
63	3	U11,U13,U15	Mosfet Driver POWER INT PWR-INT200TFI	SMT DIP8\SO	YES
64	1	VR1	Voltage Regulator 5V, 1.5A National LM340T-5.0	Thru-Hole T0-220AB	NO
65	1	VR2	Voltage Regulator 15V, 1.5A National LM340T-15	Thru-Hole T0-220AB	NO
66	2	HS1,HS2	HEATSINK For VR1,VR2 AAVID 5968B	Thru-Hole	NO
67	1	U8	COMPARATOR MOTOROLA LM311D	SMT DIP8/SO	YES
68	1	U1	SSR CP CLAIRE PD2401 x 7 IR DPA4119 CRYDOM DPA4119	Thru-Hole	YES
69	1	J10	CONNECTOR,2 PIN AMP 640456-2	Thru-Hole HD.100-2U	YES
70	1	C17	CAPACITOR,XTYPE 1UF,250VAC PANASONIC ECQ-U2A105MV	Thru-Hole	YES
71	1	F1	FUSE,5X20MM SCHURTER 034.1524	N/A	NO

REFRIGERATED MICROMAX MOTOR DRIVE BD

ASSY PN 44475 REV 14

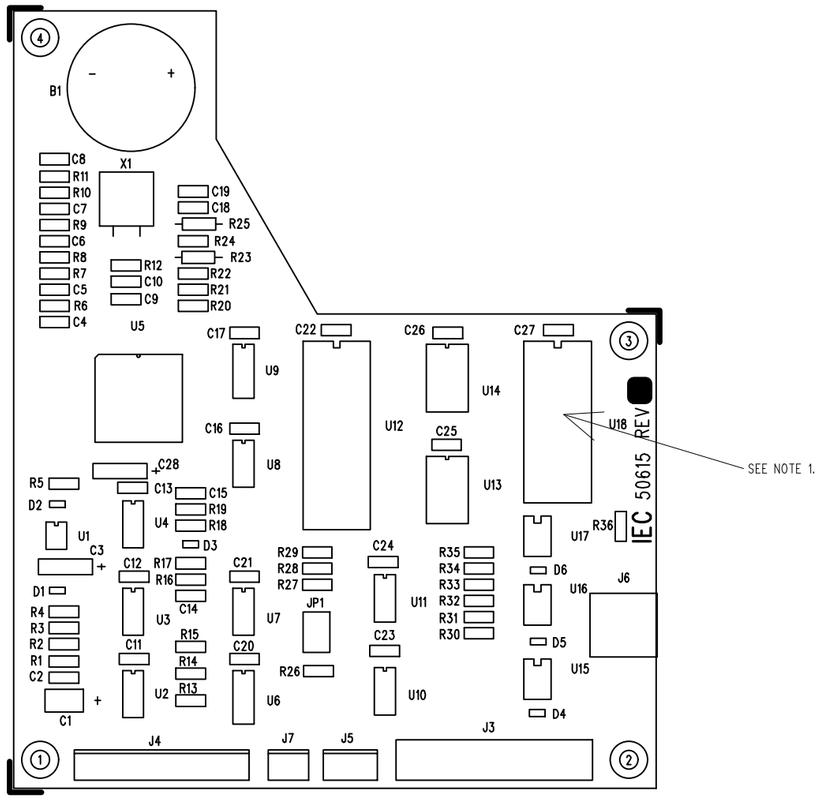
ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
72	REF	PCB	44452	N/A	N/A
73	REF	SCHEMATIC	10874	N/A	N/A
74	1	C41	CAPACITOR 100pF,50V PANASONIC ECU-V1H101JCH	SMT 1206	YES
75	1	C12	Capacitor 1000UF@25VDC ILLINOIS CAP 108CKR025M	Thru-Hole	YES
76	1	R47	Resistor 931Ω, 1% Dale CRCW12069310FRT1	SMT 1206	YES
77	1	C24	Capacitor 1uF, 16V Panasonic ECS-H1CY105R	SMT SIZE A	YES
78	A/R	FOR Q3 TAB	Tape Insulation Kapton	N/A	N/A
79	1	C4	Capacitor 2.2UF, 20VDC,Tant Panasonic ECS-H1DX225R	SMT SIZE B	YES
80	REF	35462	TEST FIXTURE / PROCEDURE	N/A	N/A
82	2	F2,F3	Fuse 3/4A, Fast Acting LittleFuse - Pico II 251.750	Thru-Hole	YES
83	1	D43	Zener Diode DIODES INC. ZM4735ACT	SMT DL-41	YES
84	3	C29,C34,C39	Capacitor Mono-Cer 1uF, 50V NIC	SMT 1812	YES

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG	CONFORMAL COATING
85	1	C47	NMC1812X7R105K50 VITRAMON VJ1812Y105KXAMT Capacitor 4.7 uF, 10V PANASONIC ECS-F1AE475K	thru-hole	YES
86	A/R		Confromal Coating Chemtronics Konform AR200		
87	3	R23	Resistor, 1/4 Watt 470KΩ, 5% 250WVDC NIC NCF25J474TR	Thru-Hole	YES
88	1	C10	Capacitor 0.1uF, 35V Panasonic ECS-H1VY104R	SMT case “Y” Tant	YES



Tel.: +(781)449-8060 Fax: +(781)455-9749

REVISION RECORD						
REV:	ZONE:	BY:	DATE:	ECO NO:	APPROVED:	DATE:
0	--	JB	07/24/97	4003	JB	07/24/97
1	--	PL	03/30/98	4447		
2	--	CM	04/27/98	4493	CM	04/27/98
3	--	DMM	12/23/98	4775	DMM	12/23/98
4	--	RAE	09/14/00	5486	RAD	09/26/00



ASSEMBLY DRAWING

NOTES:

1. VENDOR I.D. AND SERIAL NUMBER TO BE IN THIS AREA.
2. APPLY CONFORMAL COATING TO ENTIRE ASSEMBLY EXCEPT WHERE INDICATED ON THE BILL OF MATERIALS. MINIMUM THICKNESS OF COATING TO BE 0.003". REMOVE COATING FROM INNER SURFACES OF 4 MOUNTING HOLES.

DRAWN: RAE	DATED: 09/26/00	
CHECKED: HJR	DATED: 09/26/00	
QUALITY CONTROL:	DATED:	
RELEASED:	DATED:	

COMPANY: INTERNATIONAL EQUIPMENT COMANY

TITLE: ASSEMBLY DRAWING
REFRIGERATED MICROMAX
LOGIC PCB ARTWORK

CODE:	SIZE:	DRAWING NO:	REV:
	B	50615	4

SCALE: 1/1 SHEET: 1 OF 1

USED ON : MICROMAX
ASSY : REFRIGERATED MICRO LOGIC BD (PULSE KEY FEATURE)

ITEM	QTY	REFERENCE	PART/MANUF.	PACKAGE	CONFORMAL COATING
1	1	PCB MACHINED	44454 REV 3		YES
2	1	B1	TRANSDUCER AI-550KS Projects Unlimited	T-HOLE	NO
3	1	C1	CAPACITOR 33UF@16V Panasonic ECS-H1CD336R	SMT Case “D”	YES
4	1	C6	CAPACITOR 1uf 16V Panasonic ECS-H1CY105R	SMT 1206	YES
5	21	C2,C4,C5,C7,C8,C11, C12,C13,C14,C16,C17, C18,C19,C20,C21,C22, C23,C24,C25,C26,C27	CAPACITOR .1uf 50V C1206C104K5RAC Kemet	SMT 1206	YES
6	2	C3.C28	CAPACITOR 22uF@10V ECS-T1AC226R Panasonic	SMT Case “C”	YES
7	2	C10,C9	CAPACITOR 22 pF 50V Kemet C1206C220K5GAC	SMT 1206	YES
8	1	C15	CAPACITOR 1000pf Kemet C1206C102K5GAC	SMT 1206	YES
9	6	D1,D2,D3,D4,D5, D6	DIODE MMBD4148 National	SOT-23	YES
10	1	JPI	JUMPER 103747-3 Amp	T-HOLE	NO
11	1	J3	CONNECTOR 102153-2 Amp	T-HOLE	NO

USED ON : MICROMAX
ASSY : REFRIGERATED MICRO LOGIC BD (PULSE KEY FEATURE)

ITEM	QTY	REFERENCE	PART/MANUF.	PACKAGE	CONFORMAL COATING
12	1	J4	CONNECTOR 1-640456-2 Amp	T-HOLE	NO
13	1	J5	CONNECTOR 640456-3 Amp	T-HOLE	NO
14	1	J6	CONNECTOR 52018-6645 Molex	T-HOLE	NO
15	6	R5,R9,R11,R20,R21, R22	RESISTOR 4.7K CRCW1206472JRT1 Dale	SMT 1206	NO
16	16	R1,R2,R3,R6,R10, R13,R14,R15,R26, R27,R28,R29,R31, R32,R34,R35	RESISTOR 100K CRCW1206104JRT1 Dale	SMT 1206	NO
17	1	R7	RESISTOR 3.32K 1% CRCW12063321FRT1 Dale	SMT 1206	NO
18	2	R23,R25	RESISTOR 1.10K 0.5% CMF-551101DT1 Dale	T-HOLE 1/10W	NO
19	1	R24	RESISTOR 2.87K 1% CRCW12062871FRT1 Dale	SMT 1206	NO

USED ON : MICROMAX
ASSY : REFRIGERATED MICRO LOGIC BD (PULSE KEY FEATURE)

ITEM	QTY	REFERENCE	PART/MANUF.	PACKAGE	CONFORMAL COATING
20	1	R8	RESISTOR SMT 1K CRCW1206102JRT1 Dale	YES 1206	
21	1	R4	RESISTOR SMT 100 CRCW1206101JRT1 Dale	YES 1206	
22	1	R12	RESISTOR 10M CRCW1206106JRT1 Dale	SMT 1206	YES
23	1	R17	RESISTOR SMT 10K CRCW1206103JRT1 Dale	YES 1206	
24	1	R16	RESISTOR 1M CRCW1206105JRT1 Dale	SMT 1206	YES
25	2	R19,R18	RESISTOR 330K CRCW1206334JRT1 Dale	SMT 1206	YES
26	2	R33,R30	RESISTOR 390 CRCW1206391JRT1 Dale	SMT 1206	YES
27	1	R36	RESISTOR 20K CRCW1206203JRT1 Dale	SMT 1206	YES
29	6	U2,U3,U7,U8,U10, U11	HEX INVERTER 74HC14AD Motorola	SMT	YES
30	1	U4	OR GATE, 2 INPUT 74HC32AD Motorola	SMT	YES

USED ON : MICROMAX
ASSY : REFRIGERATED MICRO LOGIC BD (PULSE KEY FEATURE)

ITEM	QTY	REFERENCE	PART/MANUF.	PACKAGE	CONFORMAL COATING
31	1	U9	DECODER/ MULTIPLEXER 74HC138AD Motorola	SMT	YES
32	1	U5	MICROCONTROLLER MC68HCP11E0FN3R2 Motorola	SMT	YES
33	1	U13	3-STATE NON-INVERTING D FLIP-FLOP 74HC374ADW Motorola	SMT	YES
35	3	U15,U16,U17	OPTOCOUPLER H11A1 GE OR QT	T-HOLE	YES
36					
37	1	U6	3-STATE NON-INVERTING BUFFER W/COMMON ENABLE SN74HC365D TI	SMT	YES
38	1	U1	UNDERVOLTAGE SENSING CIRCUIT MC34164D-5 MC33164D-5	SMT	YES
39	1	X1	CRYSTAL 4.000 MHz FOX040A	T-HOLE	YES
40	1	J7	CONNECTOR 640456-2 AMP	T-HOLE	NO
41	1	U12	28 PIN DIP SOCKET I.C. 28 Pin, .6C-C CA-28MSC-1F OR CA-28MS-1F	T-HOLE	NO
42	REF	10876 REV1	SCHEMATIC,LOGIC		N/A
42	1	U14	Latch 74HC373ADW Motorola	SMT	YES

USED ON : MICROMAX
ASSY : REFRIGERATED MICRO LOGIC BD (PULSE KEY FEATURE)

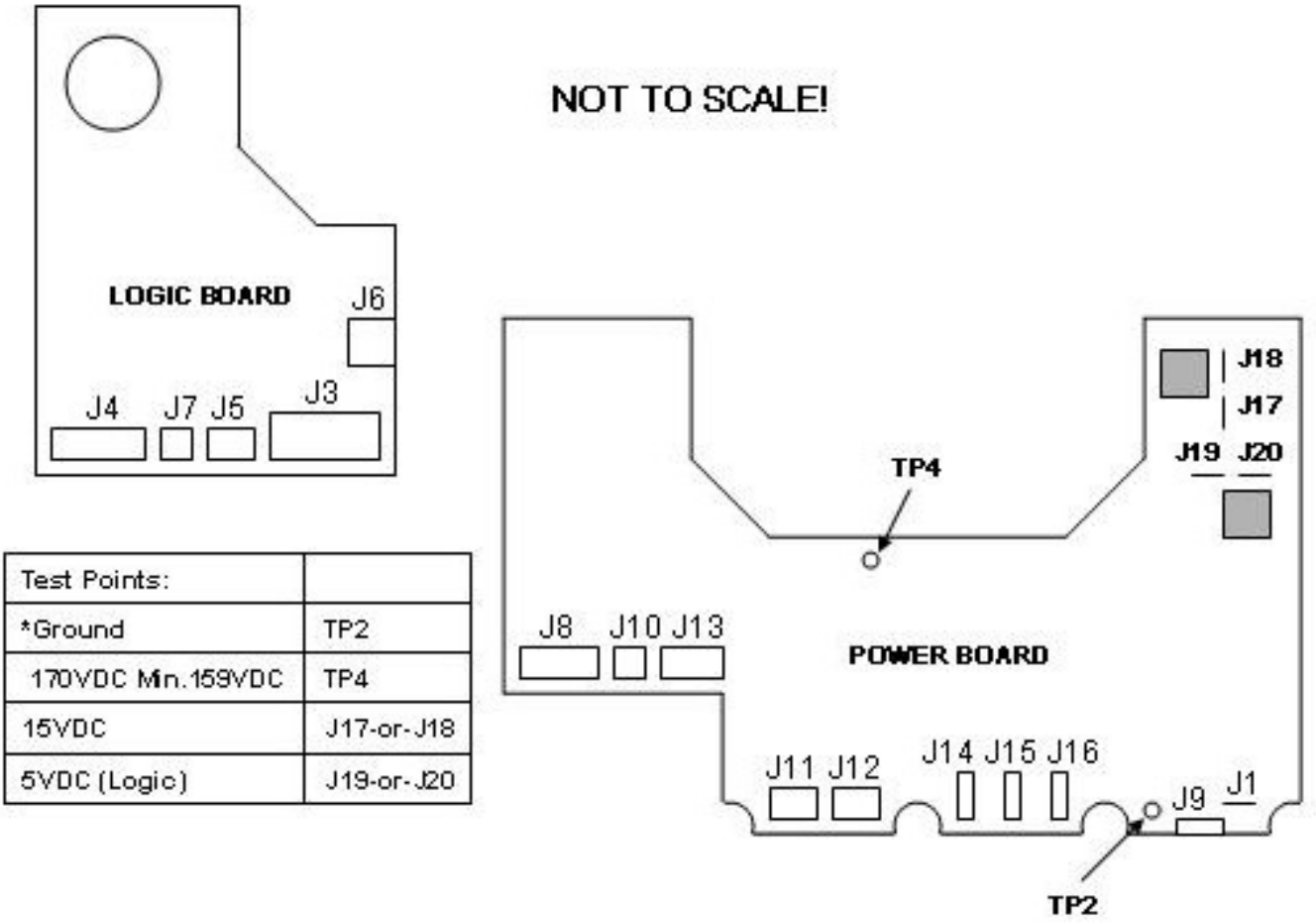
ITEM	QTY	REFERENCE		PART/MANUF.	PACKAGE	CONFORMAL COATING
43	REF	35462 REV2		TEST FIXTURE/PROCEDURE		N/A
44	A/R (2-3 MILS)			CONFROMAL COATING CHEMTRONIC KON FORM AR2000		N/A
			OR	KON FORM SR2000		

Thermo
ELECTRON CORPORATION

Instruction Sheet

Current Power Test-Point Values for Micromax and Microlite Series Centrifuges

New instruments and retrofit kits have test point values and locations which differ from the original configuration noted in the service manual. Please use the following as a guide:

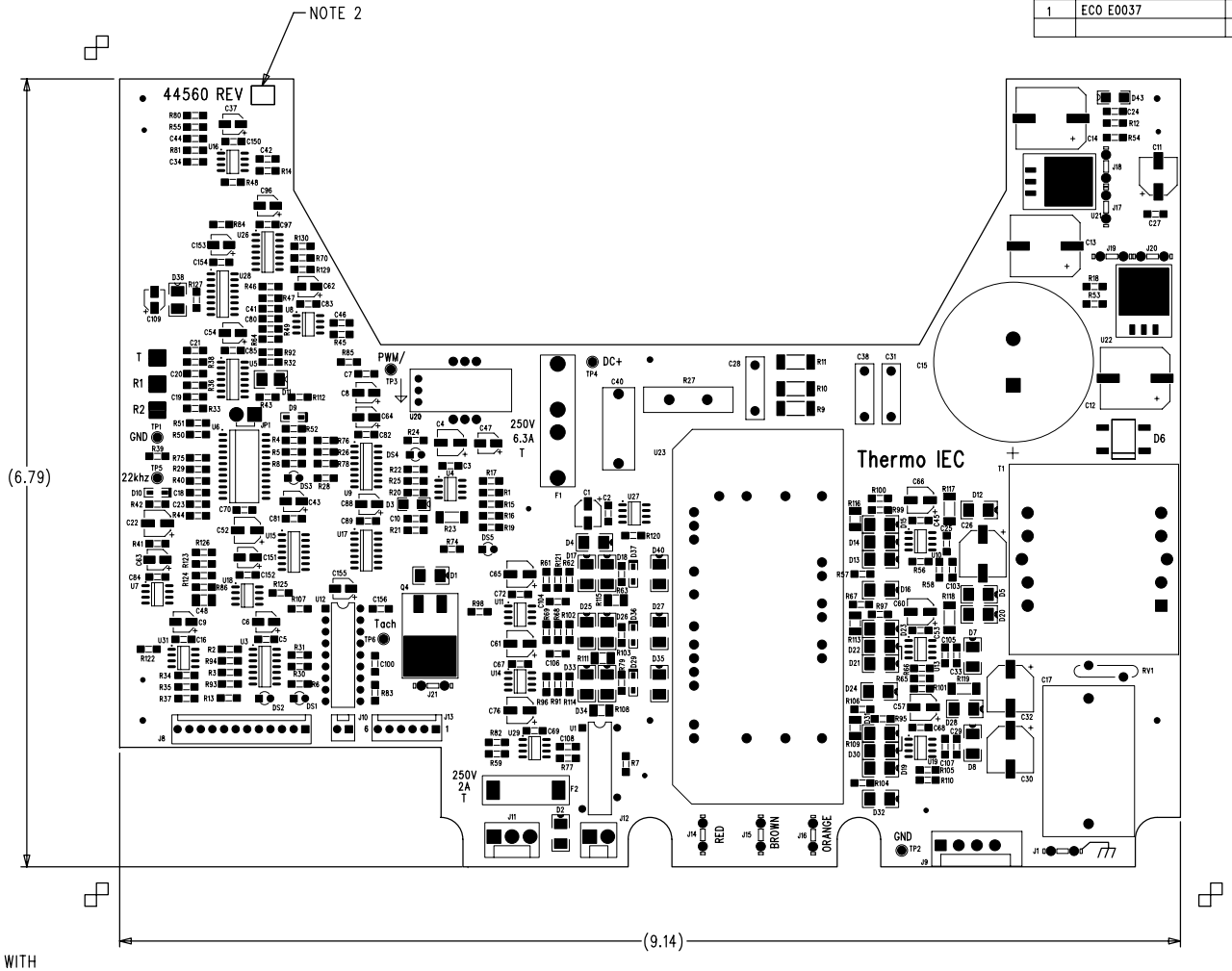


Test Points:	
*Ground	TP2
170VDC Min.159VDC	TP4
15VDC	J17-or-J18
5VDC (Logic)	J19-or-J20

Laboratory Sample Preparation
450 Fortune Blvd.
Milford, MA 01757
(508) 482-7000
(508) 634-2113 fax
www.thermo.com

DO NOT SCALE DRAWING

REVISIONS				
REV.	E.C.O. OR CHANGE DESCRIPTION	BY	APPD.	DATE
A	ECO 6120	CJS		3-15-02
B	ECO 6314	CJS		9-9-02
0	ECO 6411	JZ		
1	ECO E0037	JZ		



COMPONENT SIDE (LAYER 1)

NOTES: UNLESS OTHERWISE SPECIFIED:

1. WORKMANSHIP TO BE EQUAL TO AND COMPLIANT WITH THE REQUIREMENTS OF IPC-A-610.
2. MARK REVISION NUMBER WHERE SHOWN.
3. THIS ASSEMBLY CONTAINS ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES; STATIC-FREE HANDLING IS REQUIRED.
4. DESIGNATIONS ARE FOR REFERANCE ONLY AND MAY NOT APPEAR AS SEEN ON ACTUAL ASSEMBLY.
5. DIMENSIONS SHOWN SPECIFY MAXIMUM ENVELOPE LIMITS FOR THE FINISHED ASSEMBLY.
6. ORIENTATION OF POLARIZED CAPACITORS IS DENOTED BY A PLUS (+) SIGN. POLARITY IS IDENTIFIED ON THE PART.
7. REFER TO ASI44560 FOR OTHER ASSEMBLY INSTRUCTIONS.

PROPRIETARY NOTE
INFORMATION DISCLOSED HEREIN IS THE PROPERTY OF INTERNATIONAL EQUIPMENT COMPANY AND SHALL NOT BE USED FOR ANY OTHER PURPOSE EXCEPT AS SPECIFIED BETWEEN THE RECIPIENT AND INTERNATIONAL EQUIPMENT COMPANY

NEXT ASSY	USED ON
APPLICATION	

MATERIAL: SEE SEPARATE BILL OF MATERIALS

ALL DIMENSIONS ARE GIVEN IN INCHES

TOLERANCES UNLESS OTHERWISE SPECIFIED
.X .1 in.
.XX .01 in.
.XXX .005 in.
ANGLES P 1/2D

SIGNATURES	DATE
DRAWN Design Net	3-15-02
CHECK	
ENG'R.	
APPROVED	
ISSUED	

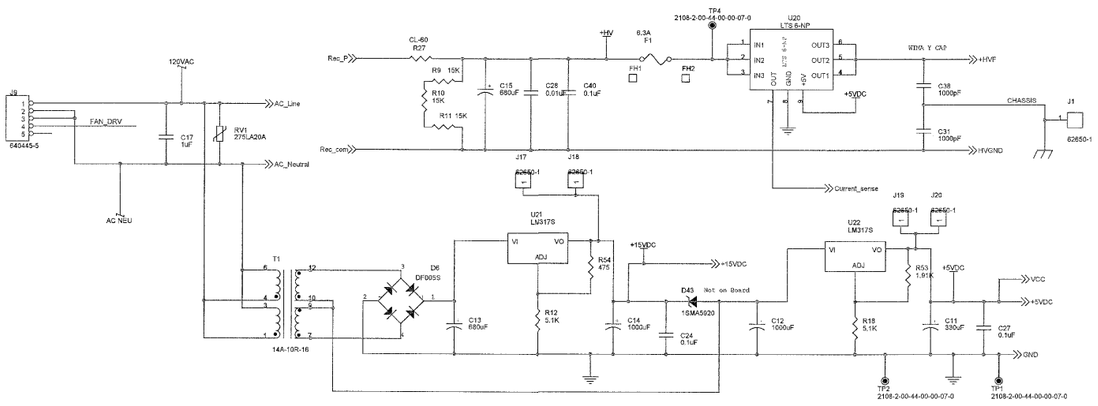
Thermo IEC

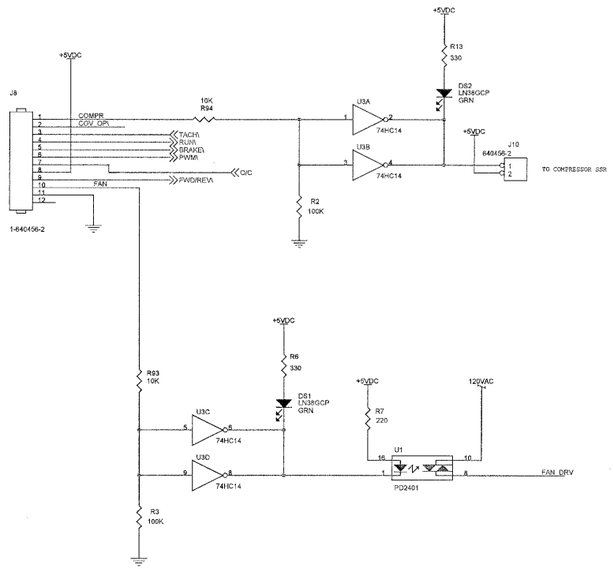
TITLE: MICROMAX MOTOR DRIVE ASSEMBLY DRAWING

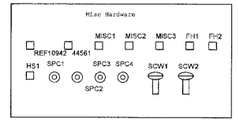
SIZE	PROJ. NO.	DWG. NO.	REV
C		44560	1

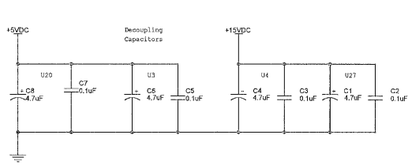
SCALE NONE | FILE: | SHEET 1 OF 1

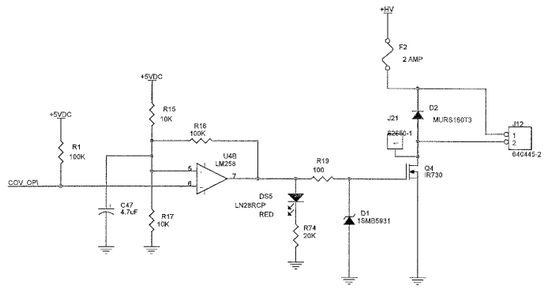
REVISIONS					
REV	BY	DATE	ECO	APP'D	DATE
A	DKB	03-21-2002	6120	DKB	3-25-02
B	DKB	08-30-2002	6319	DKB	10-02-02











ORIGINAL DOCUMENT

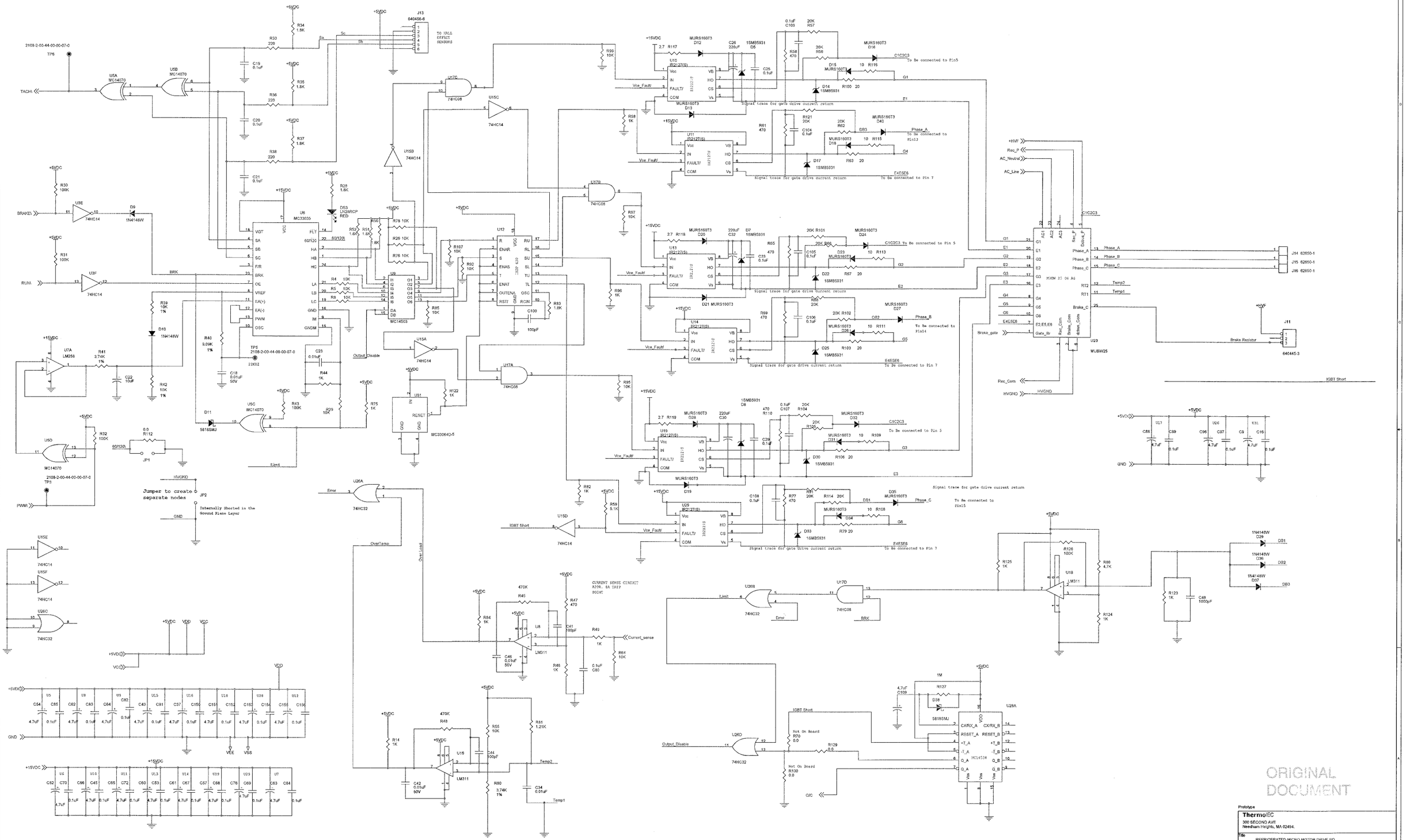
Prototype

ThermoIEC
390 SECOND AVE
Needham Heights, MA 02494.

Title: REFRIGERATED MICRO MOTOR DRIVE BOARD

Size	Document Number	Rev
D	10942	B

Date: Tuesday, September 24, 2002 Sheet 1 of 2


TACH
BRAKE
RUN
PWM
BRK
Output Disable
ILimit
Error
OverTemp
OverLoad
IGBT Short
Current_sense
Temp1
Temp2
HVGND
GND
Jumper to create separate nodes
Internally Shorted in the Ground Plane Layer
Signal trace for gate drive current return
To Be connected to Pin5
To Be connected to Pin7
To Be connected to Pin13
To Be connected to Pin14
Brake Resistor
IGBT Short
ORIGINAL DOCUMENT
ThermoIEC
300 SECOND AVE
Needham Heights, MA 02494.
REFRIGERATED MICRO MOTOR DRIVE BD
Document Number 10942
Rev B
Tuesday, September 24, 2002
Sheet 2 of 2